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REPORT OF THE JOINT COMMITTEE

on

ROADSIDE DEVELOPMENT

of the

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS
and the
HIGHWAY RESEARCH BOARD

1936

H. J. Neale, Chairman

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*A condensed report of the Activities of the Joint Committee was presented at the Annual Meeting of the Highway Research Board, November 17-20, 1936 and is published on pages 115 to 118 in Volume 16, PROCEEDINGS of the HIGHWAY RESEARCH BOARD.

Price 25¢

INTRODUCTION

The Joint Committee on Roadside Development of the American Association of State Highway Officials and the Highway Research Board held two open meetings during the year 1936: one at St. Louis, Missouri, July 6-11, 1936, and the other in Washington, D. C., November 17-20, 1936.

This report covers the summaries of the papers and discussions held at these two meetings.

The Joint Committee, at its organization, outlined five major research projects as follows:

1 - Erosion

2 - Plant Materials

3 - Zoning

4 - Highway Types and Roadside Areas

5 - Education and Public Relations

These Project Committees have not had sufficient opportunity to delve into the intricate details of research, but have devoted a great deal of time to the collection of data and to subsequent discussions. Therefore, this report is not intended to furnish technical information, but to correlate the various views of the members of the Committee and present them in such a manner as to promote more research.

REPORT OF THE JOINT COMMITTEE ON ROADSIDE DEVELOPMENT*

By

H. J. Neale, Chairman

This brief review of intensive roadside activities covers less than a decade. In 1928 an amendment to Federal Aid highway legislation permitted the planting of shade trees as a part of Federal Aid improvement, but because the cost of highway construction tended to use up all the available funds before tree planting could be considered, very little was accomplished. Prior to 1930 various committees of the American Association of State Highway Officials had discussed phases of roadside maintenance, such as care of trees, shrubs and plants, advertising signs; the cutting and clearing of vegetation on the right of way, and in 1929 the committee on Road Design recommended "That the esthetic development of the highway shall be considered of primary importance in its location and design, and that men of proper training for the consideration of this feature be employed on such work". In 1930 the Association appointed the first Committee on Roadside Beautification. No sooner had this Committee started an intensive study on the subject than we realized that the term Roadside Beautification was a misnomer, for it focused the attention of the public, as well as the engineers, primarily on esthetic features. The subsequent discussion brought out forcibly the fact that there are important economic and utilitarian factors in a comprehensive roadside development program which are of equal importance to the esthetic values. In order to present adequately the technical aspects of the subject in tangible form, it was evident that the subject would require intensive research study. About this time the Highway Research Board was urged by the American Society of Landscape Architects to make a nation-wide survey of the whole roadside development situation.

In 1932 the Committee of the American Association of State Highway Officials recommended the appointment of a Joint Committee on Roadside Development of the Association and the Highway Research Board. This Joint Committee was duly appointed and held its first meeting the following year, and has met annually since that time. In July of this year an open conference was held at St. Louis, Missouri, where delegates of State Highway Departments from all sections of the country, as well as representatives from federal departments, were present.

The rapidly increasing interest which has been manifested in the condition and development of our roadsides during the past decade has found various terms being given to the subject - first, Roadside Beautification by the garden clubs and others interested in tree planting and esthetic effects - and later, Roadside Improvement and Roadside

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*This paper presented at the Sixteenth Annual Meeting of the Highway Research Board, Washington, D. C. November 19 and 20, 1936.

Development - synonymous terms, including the engineering aspects of location, alignment, grading, drainage, erosion, zoning, safety, as well as purely esthetic features of landscape design.

When we trace the development of the vast network of roads in the United States one can easily see the reason for the popular public demand that something be done to improve the roadsides and restore their natural beauty. The earliest trails which were cut through the virgin forests, allowed sunlight and air to penetrate their density and permitted the dormant undergrowth to break forth in all its glory along the trail sides. Then came the widening of these trails to country roads, again leaving nature an opportunity to grow unhampered, and later to the intensively developed highways with their heavy cut and fill slopes and widening processes denuding the roadsides of all vegetation as well as fertile soil, leaving nature no chance for rehabilitation. In the final analysis, the basic objective of a roadside development program is to adapt the engineering and landscape efforts of men to the forces of nature. In this way a proper and permanent balance of natural forces will be economically obtained. We now develop our roadsides and landscape them for more economic maintenance, more adequate drainage, more opportunities for use by the traveling public, in order that they may be more pleasing to the eye, may offer definite safety and utilitarian factors to the motoring public, may create enhanced land values, control drifting snow and sand, and thereby make them assets rather than liabilities.

In 1934 this Committee stated in no uncertain terms that it "---- has found and maintains that practical roadside development when accomplished in accordance with approved principles of Landscape Engineering contributes to the economy, efficiency, and safety of highway maintenance and operation. In addition to these factors which elevate standards of efficiency, safety and economy are the many important considerations of increased utility and esthetic enjoyment". These statements have evidently been generally accepted. At least they have not been disputed. Why? Are they infallible or is it a case of little concern to the engineering profession? The Committee recognized the intangibility of some of these statements, and in order to substantiate them, proceeded immediately to organize five major research projects for intensive study, viz:

1. Project on Erosion. This sub-committee prepared an intensive outline report for a typical highway erosional and soil conservation research project. This was subsequently approved by the Bureau of Public Roads and the Soil Conservation Service of the U. S. Department of Agriculture and a memorandum of understanding between these agencies was issued effective May 6, 1936. On July 16, 1936, Mr. T. H. MacDonald, Chief of the Bureau of Public Roads transmitted this memorandum to the District Engineers of the Bureau with authority to proceed with the execution of this project by the several States. A more detailed report of this subcommittee will be presented by the Chairman, Professor F. A. Aust of Wisconsin.

This sub-committee has already received two completed reports from Arkansas and it is understood that Missouri, Wisconsin and Virginia have initiated or are awaiting approval of this project. It is hoped that other States will be ready to report activity within a very short time.

2. Plant Materials. This sub-committee's report which is attached hereto emphasizes the need for technical landscape analysis of the region traversed by the highway.

3. Zoning. This sub-committee has made a study of the principles of urban and suburban zoning and the adaptation of these to rural areas along highways and parkways in those several regions of the country where zoning legislation has been enacted.

It reports the following findings:

(a) The problem of securing adequate right of way is becoming increasingly complex as highway systems are improved and extended.

(b) In securing additional right of way for highway purposes it is found that in many cases so called ribbon development of lands adjacent to the highway has resulted in the building of certain temporary and unsightly structures within areas to be acquired. These structures tend to jeopardize the value of the highway investment.

(c) Much of the commercial development which follows highway reconstruction tends to encroach upon the new highway limits and here again in effect narrowing the highway and introducing various traffic hazards.

(d) It is apparent that the countryside adjoining the highway must be considered to have an important direct relationship to lands within highway limits. It is important that some means be found to regulate and control the use of these ajoining lands. This end should be accomplished by comprehensive rural zoning.

(e) In those States where rural zoning laws have been enacted their effect has as yet been purely local.

4. Highway Types and Roadside Areas. This sub-committee has been continuing their studies and collecting factual data. It was considered advisable to wait for more comprehensive outlines from other Project Committees before attempting to formulate a research outline, in order that their conclusions and recommendations might be incorporated in the studies. It is essential that consideration be given to rights of way requirements for erosion problems, planting requirements and zoning processes, as well as engineering aspects.

Educational and Public Relations

The salient points covered by this sub-committee report which is attached are:

1. Landscape engineering demands broad fundamental training in engineering, architecture ecology, horticulture, botany, entomology and other sciences relating to landscape designs. Therefore, educational standards for this profession should be comparable with those required in other technical fields involved in highway design and construction.

2. The following means for developing and training field organizations should be made available.

(a). A pictorial and descriptive record of field methods, practices and accomplished results.

(b). An outline of supplementary reading and study.

(c). A series of State and intra-State short courses or conferences.

(d). A manual of standard roadside development practices.

3. The public should be kept informed regarding progress in roadside development through the medium of -

(a). Authentic articles in the press, popular magazines and technical journals.

(b). Slides, film strips, etc., released by State Highway Departments, the Bureau of Public Roads and the Highway Research Board.

The value of the results obtained by these research project committees will be dependent on the cooperation and assistance they receive from the highway engineering organization in conducting these researches and in putting them into operation. Each of the projects is of economic importance to maintenance operations of our highway systems. We are more and more confident that the assertions made in our 1932 report are substantially correct, but to what extent a State is justified from an economic standpoint in promoting an extensive roadside program is not definitely known. We feel safe, however, in asserting that the maintenance operating costs incident to erosion alone on undeveloped roadsides as compared with the same roadsides after sloping and planting, would offset the cost of the initial construction, and over a period of years would set up a fund sufficient to comprehensively landscape many thousand additional miles.

When a pavement, bridge, or any other mechanical structure is built it immediately becomes a liability, in that it begins to deteriorate and becomes a maintenance expense. Not so with a roadside properly developed, for when a roadside is properly graded, drainage properly cared for, and ground covers and trees established, nature is again given an opportunity to work day and night throughout the year - increasing in value, building up positive assets, setting up an immeasurable reserve in utilitarian benefits for the traveling public - in enhanced land values, and an ever increasing local, State and national civic pride.

"Beauty is the crowning perfection of that which is useful".

EXCERPTS FROM OPENING ADDRESS - ST. LOUIS

By

H. J. Neale, Chairman,
Joint Committee on Roadside Development

A complete picture of the history of Roadside Development would date back to the early Puritan days of New England, when every town and city of Massachusetts had a tree warden, whose duty it was to protect public trees. But it appears that the organization of the District of Columbia, Division of Trees and Parking, created in 1871, and now under the Engineer Department, was one of the first efforts at street tree planting as a public function. In chronological order, it is apparent that Massachusetts was the first State to enact legislation protecting roadside trees (1890). New Jersey passed enabling legislation in 1893 entitled "The New Jersey Shade Tree Statute", and Newark was the first city to recognize the statute by appointing or establishing on January 20, 1904, The Newark, New Jersey Shade Tree Commission. In the same year California enacted similar laws. In 1895 Minnesota empowered the park commissioners of each city to regulate the planting and preservation of shade trees in the streets and public grounds. In 1901 finds the State of Florida passing legislation empowering the county commissioners within the State to improve, by shading, the public grounds and highways of their respective counties, and in the same year Pennsylvania passed tree protecting legislation. In rapid succession New Hampshire, Connecticut, and Ohio passed laws in 1902, and considerable enabling legislation has been enacted since that date in many other States.

Thus, it may be noted that the earliest efforts for shade tree planting developed in the cities, where the crying need first arose - to counteract the loss of natural countryside vegetation resulting from Man's "civilizing" process. As the towns expanded and the influence of the automobile was felt, people began to think of tree planting on a larger scale, broadening the influence into the country, looking to the development of the roadsides.

Massachusetts again seems to have been the pioneer, where records show that first recognition of roadside development started in 1912. Connecticut, Michigan, Pennsylvania, New Hampshire, New Jersey, Missouri, California, Ohio and Virginia soon followed, until today, due largely to federal interest and legislation the work has become nation-wide in scope.

It was in July, 1930, that the first committee on Roadside Beautification was appointed by the American Association of State Highway Officials. Under the able leadership and ceaseless efforts of Mr. Luther M. Keith of Connecticut, this committee has met annually, first in Pittsburgh, and then in 1931 at Salt Lake City, 1932 in Hartford and Washington, D. C., 1933 at Milwaukee, 1934 in Santa Fe, and in 1935 in Miami, thereby spreading the educational program for better roadsides to a major portion of the nation. The resolutions offered by the first committee in 1930 are so comprehensive that they are worthy of repetition at this time.

"WHEREAS, Roadside beautification and its varied activities reduces highway maintenance costs by checking erosion, preventing slides and controlling drifting snow, reduces accidents, increases adjacent property value, promotes civic pride, equalizes temperatures, opens and reveals natural beauty, advertises the State and provides a healthful recreation and enjoyment for all highway users.

"THEREFORE, BE IT RESOLVED, THAT

"First: Adequate width of highway right of way be acquired at the earliest time to provide for future widening and a detailed plan of beautification.

"Second: Conservation of natural growth be recognized of first importance and that unnecessary destruction of roadside plants be prohibited.

"Third: The absolute control of the right of way be vested in the Department of Highways.

"Fourth: Responsibility for roadside beautification be vested in a competent person to carry out the work of the Department and to encourage individuals and organizations to assist in beautifying town entrances and the roadside in their localities.

"The Committee is in full accord that the following activities are of primary importance and should be included in the general plan of roadside beautification. They are recommended for consideration by State Highway Departments.

"First: Secure adequate width of right of way to provide for future widening and a detailed plan of beautification.

"Second: Conservation, maintenance and care of desirable natural growing trees, shrubs, vines, flowers and grasses.

"Third: Absolute control of the right of way, including plants, utilities, etc.

"Fourth: Vest responsibility for roadside beautification in a trained and competent person to carry out the work of the Department and to encourage cooperation of interested individuals and organizations in improving town entrances and roadsides in their localities.

"Fifth: Plant, sod or seed slopes to prevent erosion.

"Sixth: Clean up and improve roadsides previous to the planting of trees and shrubs.

"Seventh: Landscape and properly plant road intersections and other suitable areas.

"Eighth: Plant shade and ornamental trees in avenues and groups along rights of way.

"Ninth: Plant evergreen trees for permanent snow breaks to replace temporary snow fences.

"Tenth: Protect, maintain and landscape monuments, milestones, and old land marks.

"Eleventh: Protect, develop and maintain desirable roadside springs.

"Twelfth: Maintain roadside trees to permit unobstructed views of traffic and open and reveal unusual scenic vistas.

"Thirteenth: Establish and maintain parks, parking places and comfort stations.

"Fourteenth: Eliminate advertising signs within or over the right of way and regulate such signs adjacent to the highway.

"Fifteenth: Encourage clean and well kept stands, filling stations and other roadside establishments.

"Sixteenth: Promote other activities that will improve and give the public better use of roadsides.

"The Committee realizes that roadside beautification is in its infancy and further studies are suggested before standards are recommended".

Today the majority of our more than 125 million people depend on the automobile and bus in their quest for recreation as well as business. Did not our forefathers recognize and declare in the Declaration of Independence, that the inalienable rights of man are life, liberty and the pursuit of happiness? This modern trend for the pursuit of happiness, being along our highways, places a great responsibility on highway administrations. The opportunity is ours, and the time has come for the formulation of a comprehensive program, workable in all sections of the country. May we make here, at this our first conference, a definite contribution to the people of our country - a contribution that will redound to the glory and credit of all the highway departments and civic agencies here represented, and to our gracious hosts.

ROADSIDE DEVELOPMENT PROBLEMS

By

Roy W. Crum, Director,
Highway Research Board

I should like to talk informally for a few minutes about the place of the Highway Research Board in the roadside development program, and our experience in helping coordinate the efforts being devoted to it. It was about 1930 when Professor Aust and Professor Elwood first suggested that the Highway Research Board should take an interest in this work. We spent considerable time wondering just what could be done; what the objectives from a research standpoint might be. As you know, it was then spoken of as Roadside Beautification and the small amount of work being done was largely artistic rather than engineering in nature.

After a while, however, we realized that much more was involved in this problem than making the roadside look better. Roadside development, which I think is a good name for what we are trying to do, covers the whole right of way of the road and it is bound to go beyond and include a part of the adjacent property. In fact, we will not have the job finished until we get the unsightly blots upon the landscape under control.

Our first thought was that we could at least provide a clearing house for information, and we started to set up an organization for that purpose, and the American Association of State Highway Officials was invited to join with us. The first meeting of the Joint Committee was held in Milwaukee, in 1932. There the Committee wrote a definition of roadside development, which, I think is a masterpiece. "Roadside development must conserve, enhance and effectively display the natural beauty of the landscape through which the highway passes, as well as provide safety, utility, economy, and recreation facilities by means of proper location, construction, and maintenance of the highways".

In general, the Association of State Highway Officials is concerned primarily with the setting up of standards, and the Highway Research Board with research work aimed toward that end. Through the facilities of the Board we have been able to bring many interests into cooperation. In the membership of the Joint Committee and Project Committees there are in addition to the highway officials, representatives of universities, colleges, and practicing landscape architects. Our Committee work has few limitations except that we do not attempt standardization work. Commercial as well as technical and official interests are recognized in the deliberations of the Committees. We seldom undertake specific research work ourselves, but through our Committees get other people to do it. An important Committee function is to digest available information and make findings and recommendations upon which other people can base their activities.

As far as Committee work is concerned, perhaps the biggest thing is the coordination of effort it affords to the interested people throughout the nation. Another duty of this Committee is the formulation of research projects. A number of Project Committees have been appointed and are going ahead rapidly. There has been a big demand for everything we have put out on roadside development. The copies of the very fine report made in 1933 are exhausted and I should like to see that material revised and brought up to date in a new report.

Another thing which I hope will be done before long is the preparation of a manual of good practice, and I think this Joint Committee would be the proper agency for the purpose. I think the engineers and landscape architects in charge of this work in the various States and their assistants would find it very helpful.

A SURVEY OF ROADSIDE DEVELOPMENT

By

W. H. Simonson,
Senior Landscape Architect
U. S. Bureau of Public Roads

The landscape development of the highway which is generally termed roadside improvement has passed through the beautification state and has now entered upon a permanent phase involving a logical and lasting improvement of the right of way. The early efforts of a few pioneer States have grown into a nation-wide roadside improvement program as the result of federal interest and legislation.

The public support which made this possible has begun to develop a more definite and intelligent appreciation of the practical benefits to be received from well organized roadside improvement planning. The public is beginning to understand that it is not a problem of artificial beautification, but one of natural improvement of the highway right of way, as a functional part of its surroundings.

With the initiation of the public works highway emergency construction program in 1933, the responsibility for roadside accomplishment was definitely placed in the hands of the technical agencies of the States engaged in the administration of highway work. During the recent emergency programs, the several State highway departments have been gradually developing organizations to handle work of this character effectively, and have been testing possible methods and administrative practices. The progress of the nation-wide movement demonstrates the possibilities of organized effort when directed toward roadside improvement objectives.

In the 1935 annual report of the American Association of State Highway Officials the Roadside Planning and Development Committee reports that roadside improvement has now approached its proper place in all the State highway programs. In support of this contention considerable evidence is contained in the February, 1936, number of the "The Roadside Bulletin" published by the National Roadside Council. This attractive publication summarizes very effectively the recent accomplishments of the various States in the primary objective of "fitting the highway into the landscape". Also the July, 1936, copy of "American Highways", published quarterly by the American Association of State Highway Officials, contains a report of progress as represented in a comprehensive engineering survey of "Roadside Development" prepared from data collected by Mr. Luther M. Keith, Director of Roadside Development of Connecticut, by Wilfred Owen, Research Assistant, Highway Research Board.

There is no doubt that the experience of each State conducting a roadside improvement program will be very useful for comparison among adjoining States. Each State undoubtedly has made some contribution to this new movement, and the advantages of exchanging information are not likely to be limited to any one phase of the roadside improvement problem. The interchange and assembly of factual data on specific problems should be mutually helpful. The collection and assembly of detailed factual information is one of the definite purposes of the Highway Research Board, and the general distribution of compilations of this kind should be particularly valuable in the future programming of roadside improvement funds.

Perhaps at this point it would be well to outline a few of the larger or more general problems of highway policy which apply to roadside improvement. From an administrative point of view, a typical roadside program may, for convenience, be divided into:

1. Preparation of the state-wide program
2. Making field surveys and plans
3. Execution of the work

Program - A well balanced program is of course desirable in the expenditure of funds for object lesson purposes (as in the case with roadside improvement work at this time). The projects should be distributed geographically over the State with the definite idea in mind that in so far as possible each division or district engineer of the State Highway Department shall have a share in the responsibility for some particular portion or type of roadside work.

A good distribution as to type of projects as determined by their most prominent features should also be aimed for; i. e. town or city approach (formal) type, rural (informal) roadside type, soil erosion type, natural snow fence type, roadside park or overlook type, and so on, as the local conditions within each State may indicate.

Each of the general types of roadside treatment may also be divided into two kinds, according to the relative degree and cost of the work involved. The "intensive" or concentrated type of project is, of course, self-explanatory, as demonstrated by an expensive city approach improvement. The "extensive" or opposite type of work pertains to roadside improvement in which large areas are covered with relatively slight expenditure per unit of length. The "extensive" type of roadside is the typical rural roadside where the primary aim is to fit the highway into the surroundings, the merging area to include or take in all that which is visible to the driver.

From the landscape architectural standpoint, both the intensive and the extensive types may be further subdivided into "formal", "informal", and "conventional" (or transition) types of landscape design - i. e. the formal row plantings at city entrances, the informal groups and natural masses along the countryside, and the transition areas between the formal and the informal called the "conventional", in which the row planting gives way gradually and not suddenly to the irregular groups of trees of the rural roadside. This is comparable to the straight road in highway location as contrasted with the curved highway, the spiral easements in the curves being the "transitions" in this case.

A well-balanced program should also aim to distribute the roadside work over both old and new highway constructions. At the beginning of the emergency highway programs, the majority of the earlier roadside improvement projects were initiated by the States in connection with older construction. The demonstration value of more recent work of this character is indicated in the present trend toward the adoption by several States of the basic features of landscaping as an integral part of new highway construction. The practical economy of integrating as much as possible the non-seasonal items of work in regular highway contracts is being demonstrated in a few of the States. The inclusion of landscape grading, topsoiling and possible seeding on all new construction mileage as a highway policy is necessary if the highway system of a State is to render fullest service to the public. After the non-seasonal stages of the work leading up to the final planting have been performed, the seasonal operations of planting (and seeding) may then be best performed as a separate landscape planting contract. Even where the force account method is in use, the administrative division of operations into logical sequence and separation of the non-seasonal activities from those strictly seasonal in character will make for more effective administration of the highway programs.

For object lesson purposes then, a comprehensive program should be carefully balanced as to:

1. Geographic distribution
2. Featured types of projects
3. Relative costs per unit length
4. Distribution over old and new construction
5. Season and non-seasonal character of the work

Surveys and Plans - A general reconnaisance over each district or division of a State should be made in collaboration with the engineer in charge of the respective division for the purpose of setting up a tentative number of alternate projects from which a final selection would be made of those projects to be included in the roadside program.

Preliminary considerations concerning each project, such as the type of work to be featured, the intensity of the treatment on the basis of unit cost, the length of the project to be set up, and the relative possibilities of the project for development, should be analyzed and a priority of work tentatively determined and established so as to assure the selection of the most satisfactory project locations, all factors considered. A preliminary survey is then begun for those projects finally selected for the program.

Every possible consideration should be given to the matter of simplifying the plan and survey work so that the most practical and economical methods may be employed in the assembly of the necessary data. Station controls should first be established as a base line. Where the roadside work is in conjunction with regular highway construction as a part of the original contract, the engineer's reference stakes and plans may be used. If, however, the landscape construction work is a separate contract on an old highway, it is generally necessary for the field man to establish approximate controls on the ground. A motor vehicle odometer may be found convenient and sufficiently accurate for this purpose, marking the surfacing at regular intervals as desired. A diagrammatic or "graphic" chart, combining approved symbols, may be found satisfactory for use in connection with certain types of projects, such as the typical rural type where the work is not intensive in character.

Typical landscape sections and brief design notes on the plan sheets should show the relations of existing conditions along the roadside to the work proposed. Each item of work should be justified in the recorded plans. The peculiar conditions along a project which may affect landscape considerations should be indicated on the plan sheets and brief reasons given for each indicated proposal.

Execution of the Work - The work may be handled either by contract or force account, or by a combination of the two methods. Experience indicates that the basic stages of landscape work leading up to the final planting can be most economically handled as an incidental part of the regular highway contract; especially such items as landscape grading, slope rounding and transitions, topsoiling, conservation of trees and volunteer vegetation, soil preparation, and similar non-seasonal operations. The final planting, and possible seeding, in connection with comprehensive improvement projects, can best be handled separately as a special landscape planting contract after the general highway contract has been completed. It is believed desirable to segregate non-seasonal from seasonal activities for convenience in administrating work of this character.

For the sake of economy and quality in the development of roadsides, it has proved desirable that landscape considerations be analyzed as far as possible before highway locations are made rather than after construction is completed. Under such a policy, it has been demonstrated that many pleasing landscape features may be coordinated in the original design and integrated with the regular construction of a highway at little if any additional cost. The grading, topsoiling, and seeding of all new construction mileage should be a regular policy as soon as possible.

It has been found that the natural approach to roadside problems wherein the work is modified to fit various local conditions is more pleasing than the mechanical or rule of thumb standardized cross-section which make no allowance for varying conditions. Variation in cross-section is the essence of roadside charm and natural expression of highway character, in combination with ground cover planting. The streamlining of the cross-section of the roadway is known to be effective as a means of reducing soil erosion and the formation of snow drifts along highways. The typical rounding of slope intersections is now considered standard highway practice.

The preparation and introduction of landscape specification items in connection with regular highway construction contracts at an early date is held to be desirable especially for such non-seasonal or partially non-seasonal operations as: selective removal of trees, stripping and storing of topsoil, rounding of slopes, obliteration of old roads, roadside cleanup, replacing topsoil, furnishing and placing loamy topsoil, cutting, lifting and placing sod, seeding, tree well construction and tree root protection.

Planting should preferably be done as a separate contract at the proper season. The proper timing of planting operations is vitally important and cannot be overemphasized because of the tendency to plant too late in the season, with consequent unnecessary plant losses. Coordination of the schedules of operations should be carefully worked out so as to give the plant material every opportunity to live and survive.

A careful check of nursery supplies of desired plant stock is emphasized because of the frequent failures in obtaining proper stock. The present specification in use for the purchase of plant materials is recognized as somewhat unsatisfactory. Revision of this specification should be undertaken with the view of bringing it into harmony with latest practice, and a careful review of plant material specifications in collaboration with other organizations concerned should make it possible to submit an approved draft to the proper committee for appropriate action. Plant material specifications, like timber specifications, have been in a chaotic state for many years because of the inherent difficulties in securing a reasonable uniformity in a natural product subject to little or practically no control in the making. In cooperation with the various agencies interested in the production and use of trees and plants, the Committee could work out a method of grading plant material which will eliminate much of the confusion which exists and assure an increased use of better quality plants in roadside work.

In a similar way there is indicated a need for some reasonable uniformity in the units of measurement employed in connection with landscape operations. So many kinds of measurement make it almost impossible to compare costs of work in the different States. Instead of using acres in one case and square yards, square feet, or what have you in another, it is suggested that 1,000 sq. ft. units of area be adopted as far as possible. The decimal system has the merits of simplicity and convenience, because it fits the 50 and 100 ft. stationing so universally used in highway construction operations. Clearing, grubbing, topsoiling, seeding, sodding, roadside cleanup and so on, might utilize such a unit of measurement to advantage.

The research committees have many practical problems before them and have the opportunity of making a generous contribution to the organization of landscape objectives, the organization of programs, the organization of roadside projects, the organization of the administrative and field personnel to design and execute the work, the organization of standards and practices, and the organization of general policies as guides for future activities. There is a compelling need for a paralleling administrative advance as well as a technical engineering advance on a functional basis.

The landscape development of highways needs an organized method of approach that will make it possible to improve a large amount of roadside mileage at a reasonable cost. Properly conceived and designed, with a well-integrated and coordinated continuing policy of highway administration, construction, maintenance, and operation, the landscape development of highways can contribute its economic share to improving the quality of the national investment in transportation facilities. It will also mean increased pleasure and safety for the motorist, and at the same time furnish a tremendous amount of economic employment.

ADDRESS

By

W. D. Waugh of St. Louis.

In 1933 your Committee listed nine States as having trained workers in charge of roadside development. I understand that forty-five States now have special departments for this work. More than half of these States are represented at this meeting.

We have made a fine start in Missouri and our Highway Commission has been generous in its support. Colonel Nelson, one of our Commissioners, has given the matter personal attention. When you travel through our State and see the improvement that has been made on roads in the past six years and remember that ten years ago we still had toll roads in Missouri, and even today have a bounty on wolves, you will see by this comparison the progress that has been made. Our road system is well started and beautification seems to be the next step.

St. Louis papers last week stated that 71 per cent of the automobiles in the world were in the United States and Canada. Probably not more than 5 per cent of the users of these automobiles have knowledge of road building, while 95 per cent look for comfort, safety, scenery and atmosphere. It is this 95 per cent who appreciate, understand and enjoy roadside improvement and beautification. Comfort is provided these motorists through modern types of pavement, safety features, properly banked curves on wide radii, wider pavements, and a determined effort to keep all types of obstructions off the highways.

Your work includes the building of lookouts where tourists may stop and enjoy the scenery or historical points, and in this connection I would like particularly to call attention to a lookout recently built by the City of Keokuk, Iowa, at Rand Park, which not only improves the park on the edge of the bluffs of the Mississippi, but provides a comfortable resting place, with rustic chairs and benches. It overlooks one of the finest views in the Mississippi Valley. I understand that this work was done by Mr. Ayers, Street Commissioner of Keokuk.

As road construction depends to a large extent on revenue from gasoline taxes and license fees, we realize the importance of the tourist, and having provided modern highways through the States our ability to attract the tourist would be through what we might call "atmosphere". Each State has local interest, natural or historic, which is of interest to tourists, and these should be preserved and made readily accessible. Santa Fe, New Mexico, for instance, has made a determined effort to maintain the old Spanish architecture, even though the new buildings may be made of concrete. Each State has something native which should be perpetuated.

It seems to me that it would be very helpful if an effort were made to revive the names for certain highways, such as the Lincoln Highway, Dixie Highway, Meridian Highway, Santa Fe Trail - and it would also mean something to tourists to refer to U. S. Highway 66 as the "Main Street of America".

Your work and your discussions will probably be confined to the various methods of improving the sites along the highways and will, of course, consider these improvements from an economical standpoint, but it might be of interest to take the viewpoint of the tourist. On a recent trip from Canada I had as a passenger a relative who had traveled considerably but had not toured by automobile any great distance in the past ten years. On arrival in St. Louis I inquired as to what points in the trip had been of most interest and it was revealing to find that roadside development and improvement had stood out prominently. There was a development along Highway 24, beside the Maumee River, in Ohio and Indiana. Also in Indiana my passenger was particularly interested in the wide highways and the rubbish barrels. We did not stop to see if there was any rubbish in the barrels, but there certainly was none on the pavement, which recalls the old saying that "you can see by the papers where the picnics have been". Indiana's Meridian Highway, north of Indianapolis, also brought a considerable amount of favorable comment. Crossing Illinois we found a number of State maintained picnic grounds, and attention was particularly attracted to the prevalence of hollyhocks planted about the gates at the entrances to farms. Whether this was done by the Highway Department or some Garden Association, we did not know.

In Missouri the Highway Department has carefully marked with name boards the names of creeks, rivers and, of course, towns. These boards not only have value as identification points but often start a new line of thought with tourists who may have been traveling for a long time and have run out of conversation.

In Oklahoma, on certain highways, particularly south of Oklahoma City, I found roadside telephones for emergency use. It seems to me that this is an excellent service for the tourists in thinly populated sections.

Many States have "Pure Water" signs. If these are properly regulated it should be an encouragement to towns, filling stations, and other public places to strive for authority to display such signs. The filling stations which, besides rendering the usual services, offer to fill the thermos bottle or jug with pure water, would be long remembered and referred to by the tourist.

There are a number of improvements which from personal observation I should like to recommend to your Association, particularly the use of flood lights on railroad crossings. In these days of long freight trains, it is possible to approach a crossing over which the locomotive may have passed by a considerable distance. In uncertain weather conditions, where the visibility is not good, this danger may not be realized until too late to make a stop. There is also the condition at industrial railroad crossings where a train may be switching, and although a flagman is stationed at the crossing he may not be noticed by cars approaching from the other side of the train.

Then there should be a uniform railroad sign put up by the railroads, and I strongly recommend the standardization of the old sawbuck railroad sign and that permission be given the railroads to put this sign on the highway right-of-way at least 300 feet from the crossing. The Missouri-Pacific, I understand, uses eight or nine different types of railroad signs which it is required to provide to comply with different laws.

At the last session of the Missouri Legislature a bill was passed to require high board fences around wrecked car lots which might be located within 200 feet of a highway. It seems to me that this law has considerable merit and certainly would be helpful in removing such unsightly spots.

In certain localities much has been done towards removing the billboards. This seems to be a difficult problem, but any progress made in the removal of these signs would certainly be helpful. Apparently the most progress has been made by local groups who have organized and agreed not to lease property for the erection of signs.

In Missouri, before we had completely organized the roadside development department, considerable progress was made in beautification of highways through district competition. Citizens would form local groups to do what they could to improve a particular section.

In connection with your work, I believe that the time has arrived to give consideration to the rapidly increasing membership in the Walk Ways Association which is sponsored in St. Louis by the Community Council. The growth of this Walk Ways Association in the past three years has been remarkable, particularly in the East. There are a number of Walk Ways adjacent to our highway system in the St. Louis area and we have recently opened a two and a half mile stretch through Forest Park.

Consideration should also be given to people who find it necessary to walk on the highways. Various suggestions have been made in this respect, even to a concrete sidewalk being built on the shoulder.

The type of work that your Association is doing is of intense interest to all automobile users within your State, and in Missouri we have developed several associations of citizens who are prepared to cooperate and assist the Highway Department in every worth while project.

We have one group known as the "Citizens' Road Committee" which represents a cross-section of citizens throughout the State. They are having a meeting in Jefferson City tomorrow which five or six hundred members are to attend.

The St. Louis Chamber of Commerce has a membership of approximately three thousand, representing a cross-section of business and professional life in St. Louis, and our Highway Committee is made up of seventy-three members of the Chamber of Commerce who are particularly interested in highway work and are ready to cooperate at all times. This Committee considers the highway problems in this district, and after a thorough study makes its recommendations to the Board of Directors, whose approval means the backing of the entire Chamber of Commerce. There have been frequent occasions when members of this Committee have taken time from their business to the extent of making door-to-door calls on business men and citizens in certain districts, in order to secure support for some ordinance which would mean the improvement of our highway systems. They have also been helpful to the Highway Department in vigorously opposing plans or politics which might be detrimental to our highways.

HIGHWAYS' FOURTH DIMENSION

Abstract of Address

By

A. P. Greensfelder, Member,
Missouri State Planning Board

Having previously thought only in terms of length, width and thickness, the highway engineer has finally added a fourt concept, appearance.

Architects, Mr. Greensfelder pointed out, have been considerably in advance of highway engineers in this respect. They plan and decorate their buildings, and the highway engineer must realize, if he would keep abreast of the architect, that roads must be protected from the wrong kind of dismemberment.

Billboards in the wrong place, it was stated, will bring ill will, so that the proper place for outdoor advertising must be decided upon through intelligent cooperation with advertising interest. The State Planning Board in Missouri has studied this question in connection with the zoning of residential and commercial districts.

The problem of utility pole installation was mentioned in the same connection, with the solution likewise declared a matter of conferring with public utility companies to find the proper place for the poles. Because utilities have the right to install poles along the highways, it does not follow that the highways were built for the poles. In city planning a place has been found for cables in the rear of lots. Obviously it is cheaper to put these things in the right place first rather than to move them later.

In speaking of roadside development work in Missouri, appreciation was expressed for assistance received from P.W.A. and CCC workers.

Another problem mentioned was the need for easements to be written in more understandable language. It was also claimed that gasoline stations are too numerous ---- that one every ten miles is enough.

Long range vision is essential for roadside development. It took vision to first conceive a fine highway commission, and in the 48 States it took imagination to realize the necessity for the Fourth Dimension.

WHY LANDSCAPE THE HIGHWAYS

Excerpt from Address

By

Hugh Stephens, President,
Citizens' Road Association of Missouri.

I am not afraid that landscaping of highways will fail to receive public support. My only fear is that the demand for it will out-run the development of sound technique. We need to promulgate a system of improvement and planting which will survive the climatic conditions which jeopardize some of the roadside work done in the first enthusiasm for highway beautification.

In my opinion no highway is complete until it environs have been treated, and the time is coming when the public, quickly educated to new standards in road building, will not feel that the job is woll done unless this detail is taken care of.

Eventually, the wise thing to do, I believe, will be to utilize natural growth adapted to existing conditions and able to withstand lack of moisture and the constant attention which is available in the upkeep of city parks.

The movement to landscape roadsides has had an obvious influence upon maintenance engineers. We witness everywhere a better kept right of way, frequently mowed, with debris gathered up, not to mention the note of art introduced into the construction of bridges and the location of new paving.

We have to pinch ourselves in Missouri because of the revolution we have worked in road transportation during the past 15 years. We thouthg that when we got out of the mud the highway problem would be solved; now, so much of life is spent in the motor car that the highway in a sense has taken the place of the home, and we must consider the social, physical and cultural factors which enter into the new picture.

The Missouri State Highway Department has placed emphasis upon roadside improvement, and its action has been aproved in all sections of the State, both urban and rural. In my opinion it more than pays for itself in added use of highways, not only by our own citizens, but by tremendously augmented travel by motorists from the outside. After all, the greater the use of the highway the greater the revenue. Our road system is built and maintained out of taxes paid in large part according to the volume of travel. Time cannot be lost in landscaping. Every year means much, and if we are going to plant at all we had better do it now.

REPORTS

OF

SUBCOMMITTEES AND DISCUSSIONS

St. Louis Meeting, July 6 - 11, 1936.

Washington Meeting, November 17 - 20, 1936.

* * *

SUBCOMMITTEE NO. I - EROSION

Franz A. Aust, Chairman, University of Wisconsin

No Personnel

EROSION PROBLEMS

By

Franz A. Aust,
Associate Professor of Landscape Design
University of Wisconsin

(Paper presented at the Sixteenth Annual Meeting of the Highway Research Board, Washington, D. C., November 19, 1936.)

In the earlier science of highway construction little thought was given to the appearance of alignment, vertical curves, and streamlines, but since the year 1932 a great deal of emphasis has been placed not only upon these but also upon the sub-grade in relation to the permanence and efficiency of modern highways. Greater care has been taken that the design of the highway conform to the contours of the ground and the geological and ecological forces which formed and shaped that ground; in other words, the countryside as a whole. The engineer has dug deeper into the problems of highway construction, but at the same time his field of activity and his interests have also widened, with the result that problems outside the right of way are becoming important as well as those immediately beneath the highway and those within the legal limits of the right of way.

Prevention of erosion has three distinct aspects: human comfort, human safety, and human happiness - in other words utility, safety, and beauty. It is well known that slippage and deposition of soil and rock due to erosion increase maintenance costs and often create traffic hazards. It is only in recent years, however, that we have come to think of these problems in relation to beauty. A very large proportion of the use of our highways is for the purpose of recreation, and a primary reason for pleasure-touring is enjoyment of scenery. Such scenery is not limited to shoulder slopes and fence lines. The eye takes in the hills, the mountains, the lakes and rivers, the plains and the valleys, sunlight and the shadow of passing clouds, the masses of trees and the stretches of wildflowers. This scenery does something to us. It brings joy and happiness to the soul. It repairs broken-down tissue; it recreates; it inspires. We come back from our trip refreshed and ready to take up again the menial tasks of every-day life. We have been invigorated and strengthened by our travel.

The Innate Longing for Beauty

There is a deep social significance in this inner urge to get back to nature, to enjoy the beauty of the countryside. Getting back to the primitive is one of the fundamental longings of mankind. Governments, regardless of their political doctrines, are all stressing the importance of this significant fact. If we are to provide food for the souls of men as well as for their dietary needs, we must consider that the art values along our highways are things worth striving for and conserving at all costs. This applies especially to the natural beauty of rural scenery.

There are many different types of natural beauty found along our highways, and each has its own place, for we must provide variety to fit the needs of the touring public. Some like the forest, some woodlands, others like the dunes, sweeping sands or the dashing waves; others like the marshy odors of the bogland with its many flowers, reeds, and rushes, its animal and bird life.

Some Problems of Erosion Control

So often these problems of scenery are intimately related to the problem of highway construction and the prevention of erosion. Adequate and timely protection against erosion will result in a material saving of construction costs in connection with regrading and resurfacing. Earlier experiments have definitely determined the fact that through erosion control maintenance costs can be greatly reduced. Scars on the landscape left by construction operations can be healed and the landscape again restored to its natural beauty. Rock cuts and deep fills may be made stately and glorified by the use of native vines. The Virginia Creeper, the Wild Fox and River Grape, the native Clematis, all may be used in this work. "The best roadside development will always be that which shows Nature the least disturbed". When all the cut and fill slopes are graded for maximum safety, the tops carefully rounded to prevent frost action and stabilized with native sod cut from adjacent meadows and banks, many of our roadsides will clothe themselves in a comparatively short space of time. The native sod brings with it not only the indigenous grasses but also sedges and mosses, wildflowers and ferns, even wild roses and low-growing shrubs.

It is now time that the roadbuilder, the engineer, and the designer not only fit the highway into the countryside, but also restore some of the charm of the countryside that was ours in pre-automobile days.

When we look at erosion problems from the standpoint of beauty, we must see them in relation to the landscape as a whole. A satisfactory solution entails not only engineering, construction, maintenance, alignment and streamlining, but also a planting scheme which unites, blends, and harmonizes the highway with the countryside of which it is a part. When we are building our highways, we are building roadways back to nature. Someone has observed that engineering is a combination of brains and materials, the less brains the more materials. Perhaps we might add; the more brains and intelligent planning the less material but the more beauty. In a solution of the problems of utility, safety, and beauty as they relate themselves to erosion control, we must coordinate as well as engage the best thought coming from engineering, soil conservation, ecology, geology, and landscape design. We are fortunate in now having all of these merged in a cooperative project.

Cooperative Agencies

Last December the Sub-committee placed special emphasis upon erosion control as it relates to highway construction and maintenance. This cooperative project is being sponsored by the U. S. Bureau of Public Roads, the Soil Conservation Service, Highway Research Board, Tennessee Valley Authority, and various State Highway Departments. The demonstrations and researches will be located in key areas and selected from those regions where the urgency of the problem will insure the best cooperation.

The following statement of purpose was outlined in the 1935 report: "The prevention of erosion along highways is a problem widespread throughout the nation. Soil treatment to prevent erosion has often proved very costly, and in many cases has not been entirely successful. The solution of this problem involves engineering questions pertaining to cross section, methods of drainage, construction of stabilizing structures, problems of location and necessary drainage structures with respect to topography. Also involved are forestry, agronomic and soils problems dealing with the establishment of most effective plant growth for erosion control".

The objective set forth was as follows: "To study methods and demonstrate practices, materials, structures, and plants best adapted for the prevention of erosion along highways under varying conditions of cross section, soil type, and climate. The study should include relative initial cost as well as subsequent maintenance".

Method of Cooperation

The Soil Conservation Service has offered two types of work to the State Highway Departments: (1) Research work which is conducted on State highways will go forward under an agreement between the State department and Soil Conservation Service only. (The Bureau of Public Roads will act as consultant). (2) On Federal Aid Routes, the Soil Conservation Service will enter into a three-party agreement; The State department, U. S. Bureau of Public Roads, and the Soil Conservation Service.

The Soil Conservation Service will also advise with the State departments on State roadside improvement projects where erosion is a major factor in such roadside development.

The above outline will suggest many different combinations and possibilities to the various State departments. It offers the best engineering skill available in the field, and this year should see us in full swing in several different localities.

Up to the present, considerable time has been spent in coordinating the viewpoints of the different cooperating agencies. These matters were quite fully discussed at the St. Louis Meeting. Early in

September there was set up in the Arkansas area a project aggregating five miles. Other projects have been definitely started, one in La Crosse County, Wisconsin. The work has benefitted by earlier efforts along this line in the Tennessee Valley. The writer has personally visited and is familiar with the details of the La Crosse County project, and has observed the various experiments and demonstrations along the freeway at Norris, Tennessee, a project now going into its third year.

Erosion Control in the TVA

Many interesting approaches to the problem have been undertaken and worthwhile results have been obtained. A general outline of the erosion studies is as follows:

Erosion (1) on cut and fill slopes; (2) in highway ditches; (3) in waterways below highway drainage structures; (4) in waterways above and leading down into highway drainage structures.

Erosion on cut and fill slopes is perhaps the most obvious type of preventive work. The work which the engineer has done in streamlining the highways and in rounding back the slopes, instead of leaving the usual railroad engineering angles and scars, has contributed much to the solution of some of the problems. There are definite methods which have been tried in the TVA area which will be extended over a wider range of territory and are certain to bring fruitful results. Particularly among those are the methods of establishing grass or equivalent ground cover. It is extremely difficult and often a long procedure on the part of Nature to cover a slope (either fill or cut) which is too steep. Mulching with straw or marsh grass, covering this with brush to prevent slippage and washing away, and sowing grass seed directly upon the mulch have proved to be satisfactory and quick methods of treatment. The use of fertilizers to build up raw soils before seeding operations are started has also proved effective. Sodding and spot sodding have proved successful on certain types of the heavier soils. Bermuda Grass, Virginia Bent, and Brome Grass lend themselves particularly well to the spot sod method. Sodding is an expensive procedure, but where the steeper slopes are absolutely essential, sodding is the method which must be used.

In any method ofseeding and sodding, a very important factor is the exposure of the slope. Experimental work has clearly demonstrated that what is often successful on an east and north exposure will not be at all satisfactory on slopes which face south and west. Also the season of the year is an important factor in the method to be tried. Sudden thawing and freezing which prevails on the south and west exposures would have little or no detrimental effects on north and east exposures. In the use of mulch and brush, ways and means must be devised to lessen fire hazards. One may hope that the research projects going forward may result in definite recommendations and standardized methods of practice for each particular area, soil type, and exposure within that area. It is obvious that no general blanket order or recommendation could be made which would apply equally well over an area of any great extent. Even in Wisconsin we would have to divide the State into four or five regions. In some cases they might follow the natural highway divisions; in others they would cut across boundary lines.

When we turn to the prevention of erosion by means of planting trees, shrubs, and vines, less definite information is available. Certain techniques have been developed, namely, the use of wattles, the seed spot method of planting trees, and the selection of species for different soil types, but these are still very decidedly in the experimental stage.

Use of Foreign Materials Questionable

The use of Japanese Honeysuckle is being accepted generally in certain sections of the country, but there is reason to be dubious about the results. When we see the disastrous effects --- the choking out of large blocks of native vegetation ---- due to dissemination of this plant in the Pennsylvania and Virginia areas, we must of necessity be in doubt. This may lead to acceptance of the principle that only native and indigenous plants, or those which have been thoroughly tried over a period of at least a century, should be used for the prevention of soil erosion. The promiscuous dissemination of introduced foreign or immigrant plants may be the source of many troubles in the years to come. Dr. Frederic E. Clements, of the Carnegie Institution of Washington, and consulting ecologist for the Soil Conservation Service, gives the following practical consideration as a guide in roadside development: "(1) By the use of native plants the cost of maintenance is reduced to the lowest possible point. (2) They require lower costs in time and cash outlay. (3) A definite ecological succession can thus be established. (4) Greater returns to the individual and to the community of a closer acquaintance and greater sympathy with the outdoor environment in which recreational and spiritual values are to be secured".

Erosion in highway ditches is distinctly an engineering problem, and efforts toward its solution are well under way in many sections of the country. Here again, emphasis should be placed upon the very best that is known in design so that the principles of beauty and art may be recognized throughout. Structures which do not conform to the general terrain and the geological and erosive forces at work will soon be washed out and prove ineffective. When we work with Nature and according to her laws, we usually find a simple and easy solution to our problems. When we work against Nature and violate the principles established, we usually find that our problems are difficult and our attempts at solution inadequate if not futile.

Erosion in waterways below highway drainage structures has two distinct aspects: that of engineering and that of landscaping and forestry. An important observation which is coming into the consciousness of highway engineering is that the problems of erosion do not terminate with the legal limits of the highway. It is often necessary to set up projects in cooperation with adjacent property owners. The changing of the water-table by highway construction methods often creates difficult land-use problems for the adjacent and sometimes unsuspecting farmer.

Erosion in waterways above and leading down into highway drainage structures likewise has its engineering, forestry, and landscaping aspects. In the solution of the two latter problems it might be observed that adequate land-use and zoning are important factors. If definite areas adjacent to the highway could be set aside for tree growth and maintained under good woodlot practices, very often much of the work of erosion control would be simplified. Thus we see that problems which appeared to be only problems of erosion soon carry us into the broader field of rural and regional planning. There rests upon the highway engineer an ever-widening responsibility, and it would seem he is virtually becoming his brother's keeper. The welfare of farming depends upon farm-to-market roads as well as upon through highways, but what the engineer does with the drainage system he establishes may also be important in determining what is good farming practice.

As a designer of landscapes and a user of public highways, the writer is very much concerned with the problems of the future. Many of our major highways will at least have two-lane traveled ways for traffic in each direction, having a dividing strip with carefully grouped plantings to minimize traffic hazards. These dual multi-lane highways for the separation of opposing streams of traffic may be on different levels and at various distances apart to follow the natural contours of the adjacent terrain. If the heavily traveled roads of the future are to be freeways of these proportions, our erosion problems will be tremendously magnified and our landscape possibilities very much extended. Thus it behooves the highway engineer and the landscape designer to urge the importance of these research studies. This work which is being sponsored by the Highway Research Board of the National Research Council is timely, but it would seem that its program must be accelerated in order to keep up with even the present demands for information along these lines.

Committee Recommendations

I. We urge upon the various State highway departments the importance of availing themselves of the opportunity of roadside demonstrations in soil erosion prevention, and also of such as the research studies of this project.

1. Outstanding climatic conditions.
2. Special nature of surface and subsoil conditions.
3. Variety of exposure to sunlight.
4. Seasonal nature of planting and seeding; i. e., spring and autumn.

II. We urge the cooperation of the State highway departments in the collection of obtainable data either of an engineering or landscaping nature which is of value in the field of erosion control.

III. The basic factors of selection of plants for erosion control on the highway and adjacent erosive areas where the run-off affects highway maintenance and protection are as follows:

1. The indigenous character of the adjacent landscape should be accentuated and preserved.
2. Native plants, those found in the area before the advent of the white man, should be used and restored wherever possible.
3. The highways should be "roadways back to nature".
4. Native plants have acquired resistance to fungus diseases and attack.
5. Being a part of the balance established by nature, epidemics of disease or insect attack are balanced by diversified groups of plants.
6. Exotic species, because they are out of balance with other plant life, if used too extensively may be wiped out in the future by an epidemic of insects or disease.
7. The conservation and restoration of native plants offer better protection, food, and nesting places for song and insectivorous birds as well as small game. All of these are essential in the maintenance of the balance established by nature.
8. The application of these basic principles for the preservation and restoration of nature's balance will assure economical highway maintenance. The problem of erosion when thoroughly understood becomes very simple.

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Highway Erosion Control in the Tennessee Valley. A report to the Committee on Roadside Development of the Highway Research Board, National Research Council, at Washington, November 18 and 19, 1936, by John E. Snyder and C. C. Davis, Watershed Protection Section, Forestry Division, Tennessee Valley Authority.

U. S. D. A. Circular No. 380 "Erosion Control on Mountain Roads" by Charles J. Kraebel, Sr. Silviculturist, California Forest and Range Experiment Station, Forest Service.

HIGHWAY EROSION CONTROL IN THE TENNESSEE VALLEY

A report to the Joint Committee on Roadside Development
at
Washington, D. C., November 18 and 19, 1936.
By

John E. Snyder and C. C. Davis,
Watershed Protection Section
Forestry Division
Tennessee Valley Authority

The Tennessee Valley Authority is interested in the control of erosion within the drainage area of the Tennessee River. It is recognized that a considerable amount of erosion in the Valley is directly attributable to highways -- both newly constructed roads and those of longer standing.

Before embarking on a valley-wide program of highway erosion control, it was considered advisable to make a study of the technique involved. This study includes experimental erosion control work on highways constructed by the Tennessee Valley Authority to replace existing roads covered by impounded waters from flood control dams. These experiments are being carried forward by the Forestry Division of the Tennessee Valley Authority with the aid of Tennessee Valley Authority CCC camps located in the Norris Lake Area.

Experimental work was first started in July, 1935, and a preliminary report was presented to the Highway Research Board at its annual meeting in December, 1935. Representative sections of newly constructed primary and secondary roads were selected as experimental areas, and observations were made from time to time on planting work which has been done on the Norris Freeway under the direction of the Land Planning and Housing Division of the Tennessee Valley Authority.

The experiments covered sections of roads through a cherty limestone clay formation with occasional areas of a mud shale. The secondary roads have a cut slope designed as 1 to 1, but actually constructed steeper in many cases, and have a fill slope of 1½ to 1. The only variant from this practice on the primary roads is that cuts under 6 feet were flattened to a 3 to 1 slope. In a very few cases where right of way was sufficient and borrow material was needed, deeper cuts were sloped to 3 to 1.

It was recognized that a basic purpose of the experiments was to stop additional erosive action on adjoining lands caused by storm water from highway drainage structures and side ditches. This principle was followed on all sections of roads where control work was done.

Care was taken when the roads were built to locate drainage structures in such a manner as to cause a minimum of erosive action before storm drainage reached the culvert and after it was released. Due to the topography of the country the best location was, in many cases, none too good, and supplementary control measures were required.

The means of accomplishing this control varied with the individual case. Drop inlets at the upper ends of culverts were used. Outlets from culverts and side ditches were paved to a non-erosive grade or surface with rock masonry, loose rock, or brush, the technique employed varying with the volume and velocity of water expected. In some places dams were used in place of paving.

In side ditches a maximum grade of 4 per cent without supplementary control was arbitrarily established, and later observations has shown that in the average case this figure is substantially sound; however, type of soil and volume of run-off are the final determining factors in establishing this maximum grade.

Three methods of ditch control were used, namely: brush paving, rock paving and masonry checks.

Brush paving was used where a maximum run-off of 5 cu. ft. per sec. was expected, or where the ultimate aim was vegetative control. It consisted of a $1\frac{1}{2}$ to 2 in. layer of brush wired down tightly over a 1-in. layer of straw to conform to the ditch cross section.

Masonry ditch checks and loose rock paving were used where a run-off of more than 5 cu. ft. per sec.was expected.

Masonry ditch checks were built of rock and mortar 12 to 18 in. deep and 8 to 10 in. wide, with the surface flush and conforming to the cross section of the ditch. These checks were spaced so that the bottom of one check was 1 to 2 in. higher than the elevation of the top of the next check down the ditch. In localities where rock is not easily accessible concrete ditch checks are used.

Rock paving consisted of a 6-in. layer of large flat rock placed and tamped on a bed of straw in such manner that the surface of the paving conformed to the cross section of the ditch. This loose rock was at times reinforced by binding 1-ft. section with mortar at intervals of 10 to 20-ft.

Having been adapted from a fairly well-established technique on abandoned farm land, erosion control measures used on outfall drainage have been quite satisfactory. Side ditch control has led to a difference of opinion concerning the relative merits of ditch checks as opposed to paving. Both methods of control give satisfactory results as far as the prevention of gullying in side ditches is concerned. Labor required for the two methods is approximately equal, but less material is needed for ditch checks.

When berm ditches were used to protect cut slopes from run-off on adjacent land, care was taken to compute the expected volume of water and to make the ditch of ample size. Where the grade exceeded 1½ per cent, brush or rock paving was used to protect the bottom of the ditch. Care was taken at the outlet to keep the flow from berm ditches from causing additional erosion.

In control of erosion on cuts and fills all mechanical devices used were contrived with the idea of assisting in the establishment of a vegetative cover.

Planting undertaken on the steeper cuts has been on the whole disappointing. Grass mixtures seeded with a protection of mulch and brush showed good growth during the first growing season, but second year results have been poor. On flatter slopes however, grass cover has become well-established by the end of the second season.

Approximately 30 per cent of the straw and brush mulch cover on the steeper slopes was destroyed by the end of the second growing season. Some of this destruction was due to stakes loosening when the earth into which they were driven became water soaked, or to the whole bank sliding. Another serious loss was destruction by fire. Fire gaps have been left in later work to prevent this form of loss.

On fill slopes of 1 on 1½, grass mixtures protected by straw and brush mulch have shown improved results at the end of the second growing season. Observations made on some fills on the Norris Freeway at the end of the third growing season show complete cover and stabilization.

Spot planting of honeysuckle on slopes up to 1 on 1 has been fairly successful on both clay and shale soils. A mulch and brush cover seems to have little effect on the establishment of honeysuckle, although frost heave is diminished by this practice. Honeysuckle planted in rows gives about the same survival as spot planting. Best results have been obtained from sod strips of honeysuckle planted in contour furrows.

Some kudza was planted in the Spring of 1936 at the base of deep mixed rock and earth cuts, both in limestone and shale formations. We have approximately 25 per cent survival of the original planting, with the surviving plants showing a good growth for the first season.

Locust seedlings planted on fills show remarkable results at the end of both first and second growing seasons.

Data sheets, giving the original characteristics -- slope, exposure, soil, etc. -- of each hundred foot section where work was done, have been kept for primary roads. Any treatment was noted with dates and other information. A Spring and Fall check-up of results has been initiated, but insufficient time has elapsed for any positive conclusions to be reached.

The Norris Freeway has some 1 on 2 cut slopes on which bermuda grass spot-planted with a light mulch has become well established in a single growing season. Interception ditches were used to protect the longer slopes. The same treatment of $1\frac{1}{2}$ to 1 fill slopes has brought even better results. Grass on flatter cut and fill slopes, together with a variety of shrubs and trees, are on the whole in good condition at the end of two growing seasons.

Trends, although far from conclusive, may be noted as follows: for the steeper cuts, honeysuckle or kudzu, if anything; for those less steep, bermuda grass or a mixture of other grasses, shrubs, and trees; for high fills, $1\frac{1}{2}$ to 1 or 2 to 1 slopes, trees or bermuda grass; for flatter and lesser fills, grasses, shrubs or trees, or a combination of these depending on individual locations. Care must be taken not to obstruct a driver's present or future view of the road.

From an erosion-control point of view, any well established vegetative cover will hold the soil. The choice of plant material for highways, within the limits outlined above and those yet to be determined, should be dictated from an esthetic point of view.

Note: For further information on Erosion, See paper by O. L. Kipp, Joint Meeting of Departments of Design, Maintenance and Roadside Development.

EROSION - DISCUSSION

A brief review of the work of this Committee was presented by Chairman Aust, who emphasized the fact that erosion control is very important from the standpoint of reducing highway maintenance costs. In the State of Wisconsin there were about eight miles of road where erosion was so severe that an expenditure of $10,000 per mile had been necessary, largely because erosive action had not been controlled by proper vegetative covering. Mr. Gries mentioned the fact that in Illinois a survey had disclosed the need for immediate erosion control work on 1,100 miles of roads.

Discussion was held on the subject of the erosion program planned with the cooperation of the U. S. Bureau of Public Roads, State Highway Departments, the Tennessee Valley Authority and the Soil Conservation Service*. A memorandum sent by the U. S. Bureau of Public Roads to the highway departments stated: "If a State Highway Department is interested in undertaking cooperative projects of this character, preliminary arrangements should be worked out jointly between the highway department, the regional officer of the Soil Conservation Service (in applicable cases the Tennessee Valley Authority), and a representative of this Bureau. Such base plans as are necessary for the project will be prepared by the State Highway Department, and the details of treatment will be agreed upon by representatives of the State Highway Department and the Soil Conservation Service (or Tennessee Valley Authority) with the thought in mind of determining the practicable application of such methods of treatment to prevailing problems of a similar character in the State. It is expected that the State highway department would assign a representative to such work during its prosecution to obtain full benefit of the methods and procedure followed".

Initial experience in Arkansas, according to Mr. Humphries, had not been satisfactory. During the previous year 17 or 18 projects had been started with the Soil Conservation Service, but the work was done in a haphazard way, and due to lack of organization very little was accomplished. Mr. Davis of the Soil Conservation Service in Texas, Arkansas and Louisiana was then sent down, and helped to plan a definite program. Arkansas has a right of way agent obtaining easements for soil erosion control. Every region has been assigned a man serving in a capacity similar to that served by Mr. Davis.

The Chairman noted the fact that original erosion projects were concerned only with slides and surface erosion on the highway right of way, but that further study by the Committee had produced definite indication that in order to control erosion on the right of way it is necessary to consider the entire drainage area involved. This includes the control of surface water within the drainage area which would otherwise find its way to the highway, and also the control of ground water, especially in agricultural regions. The Committee is interested in the control of water, whether surface or sub-surface, reaching the highways causing erosion and subsequently impairing drainage. It is also interested in water on the highway itself, interfering with farm operations, creating silt beds, and otherwise damaging property adjacent to the highway on the run-off.

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* See footnote at end of discussion.

With regard to the sub-surface water table, Mr. Simonson called attention to the way the "V" type ditch section influences the ground water immediately adjacent to the ditch, but does not solve the problem of ground water under the center of the road surface. This is particularly true where light surfacings are used. When streamlining the roadway it is believed that the flattening and rounding of ditches and backslopes will tend to stabilize the subsoil moisture. The maintenance engineer is not so much worried about the presence of moisture in the road as about the results which take place due to frost action where ground water is not stabilized.

The matter of taking care of soil erosion problems during construction was discussed by several members of the Committee. Mr. Humphries told how in Arkansas, along thousands of miles of highway erosion had set in. Ninety per cent of erosive conditions result not from the elements but from inadequate design, and if a hard fight is waged for complete design, erosion can be stopped before it starts.

*Mimeographed forms are available at the Highway Research Board which outline the working agreement between the Soil Conservation Service and the State Highway Departments. There may also be obtained copies of the Preliminary Highway Erosion and Soil Conservation Project Report, which contains questionnaires with regard to the project area under consideration. These field survey questionnaires include the following subjects: (1) Climatic conditions, (2) General Project Area History, (3) History of Highway Project Area, (4) Alignment - Profile, Cross Section and Other Engineering Features, (5) Landscape Features, (6) Soil, Underlying Rock and Rock, (7) Plants and Plant Indicators (Surface Vegetation), (8) Erosion Control Methods.

SUBCOMMITTEE No. 2 - PLANT MATERIALS

Walter D. Ludwig, Highway Forester, Chairman,
Pennsylvania Department of Highways,
Harrisburg, Pennsylvania.

No Personnel

* * *

PLANTING*

By
Walter D. Ludwig, Highway Forester,
Pennsylvania Department of Highways,
Harrisburg, Pennsylvania.

The subject of planting, particularly naturalistic planting has been more or less misunderstood in the past by most of those both in and outside this work. No blame or criticism can be attached to the old viewpoint, however, because roadside development has shown considerable improvement in technique and practice during the past five years. In support of this changed aspect a statement made a short time ago by Mr. R. W. Crum, Director of the Highway Research Board, is significant:-

"Roadside improvement meant largely to its proponents the planting of trees and shrubs, but roadside development as now in wide usage signifies the improvement of the road as a whole and involves important engineering as well as esthetic features. Planting is important, yes, but not as an end in itself; it is one factor only in the larger problem.

"From the esthetic point of view it is now realized that ornamentation is not the aim, but that the job is to conserve the landscape by adjusting and adapting the highway so as to make maximum practical use of the landscape without unnecessarily disturbing the balance of nature. From the standpoint of utility the objectives are to promote safety, facilitate upkeep and enlarge the usefulness of the road. Wide shoulders, easy slopes and shallow ditches not only look better but they are safer and easier to maintain, and the development of roadside areas where a traveler may stop to rest and perhaps to picnic is filling a real need".

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* No formal report was submitted by the Subcommittee on Planting, but this paper was presented before the roadside development session of the Sixteenth Annual Meeting of the Highway Research Board, Washington, D. C. November, 1936.

The Pennsylvania Manual for Forestry and Landscape Practices along that highway system says, "The ultimate aim of any roadside development is to cover up construction scars and other man-created situations along the highway in such a manner that the whole highway development blends naturally into the native landscape".

Dr. Frederic E. Clements of the Carnegie Institution of Washington has this to say:- "It --- affords a method for returning the roadway, which in spite of its necessity is a violation of the landscape, to its proper place in the natural setting, and thus makes it the focus of a design for enhancing the charm of nature instead of diminishing it. ---- By natural landscaping is meant the use of native materials in accordance with nature's own artistry ---- Every great climate expresses itself in terms of a particular vegetation or climax ----- the climax and its constituents are native in the highest possible degree, even though within its wide area there are regional variations that necessarily limit the range of many species".

Planting therefore in its broadest aspect is important, but it is only one factor in the larger problem of roadside development. Furthermore, planting design must be naturalistic - it must follow nature. Colonies and natural groupings must be developed, except in special cases where a semi-formal design is indicated or desirable.

Purposes of Planting

The principal reasons for roadside planting operations in general may be briefly summarized as follows, in the order of their importance:

1. To control washing and erosion, and thus reduce maintenance costs.

2. To control snow and wind, thus reducing snow removal costs.

3. To regulate and direct traffic, such as on center strips, berms, intersections, inside of curves and similar areas, thus improving traffic safety conditions.

4. To furnish some shade and protection to the roadway.

5. To create more favorable public opinion. (Toward highway reconstruction).

6. To give esthetic effect.

While it is true that the planting of any suitable material on or along the roadway does add to the esthetic effect, yet it is certain that the most important purposes of planting are to reduce ultimate maintenance costs and improve traffic safety conditions. Therefore planting slopes and fills, and snow and wind barriers are most important.

Perhaps equally important are the plantings made to regulate and direct traffic, such as on center strips, berms, intersections, inside of curves and similar areas. Proper division of traffic by a center strip, planted to grass, vines or low growing shrubs, is one phase of highway work which is now in its infancy, but which will demand more attention in the future. Some of the States have already started this work, but most of them have not realized the magnitude nor the pressing need for prompt consideration of this problem. In this connection, it is noted that Pennsylvania is planning its first divided highway for completion in 1937.

While the planting of shade and ornamental trees is not so important, yet it is conceded that such plantings do furnish some protection to the road metal in that these plantings tend to diffuse the summer heat to a certain degree; while in winter they tend to prevent rapid freezing and thawing, thus giving some protection to the road surface.

In many cases, interested organizations, clubs and individuals desire to cooperate in the making of plantings along the roadside, and the establishment of such plantings tends to create a more favorable public reaction.

Finally there are plantings made for esthetic effect primarily, but which can be construed as falling somewhat within the previous classifications. In fact, it is almost certain that some other purpose can be given for such plantings although they may be primarily for esthetic effect, and it is recommended that these other purposes of planting be emphasized rather than the esthetic effect. It is believed that this procedure will have a better effect among highway officials and the public until such a time as roadside development is recognized as an integral and necessary part of highway construction, operation and maintenance, and as such will be entitled to proper recognition.

Planting Materials and Procedure

It has been found impossible to standardize planting materials because of varying conditions of climate, soil and other features peculiar to various sections of the country. However, some general principles are outlined as a general guide in such work:-

1. Native material should be listed and used so far as possible. The landscape engineer should have a complete survey of the location of available material and should use it on his projects. It is recommended

that each State prepare a list of material suitable for the State, following the classification recommended by the Bureau of Public Roads. Such a pamphlet has been prepared for Pennsylvania, entitled *Standard Key and Plant List.*

2. The use of exotics or material not native is not recommended unless it is certain that such material will give satisfactory results and will blend in with the native landscape. Only actual experimental work will determine this question.

3. Native sod, while expensive to place, has given satisfactory results at important locations where the initial expense is warranted.

4. Grass seed cannot be standardized except for certain areas or sections. It is advisable to develop perhaps three or more formulas for such seed and use them as indicated for the local situation. In some cases where a quick cover is desired for protection, rye, oats, wheat, cowpeas, and similar nurse crops have been used successfully, but a permanent cover must be provided later, for such species are only annuals. A nurse and soil improvement planting of black locust (Robinia pseudoccacia) or moss locust (robinia hispida) has been used successfully in Pennsylvania, with the result that the planted areas have been reclaimed with desirable native growth within three to five years. All grass seeds should be rigidly tested by State or other authorities to see that they meet specifications, especially germination and purity tests.

5. Care should be exercised to use species of plants which will require a minimum of maintenance, because in the final analysis, reduced maintenance costs are the desired result. Native vines and low ground cover plants are generally recommended.

6. In many cases it will be advisable to supplement the plant material with other structures such as native stone walls, rip-rap work and sometimes steel and concrete. Where there is great danger of washing and erosion the use of these extra materials in the first place will be found most economical and satisfactory, and will more than warrant the increased initial expense.

7. Where noxious weeds, as determined by the various State and federal regulations, tend to occupy slope or fill areas, it is not recommended that these be pulled out by the roots, but rather that they be cut off close to the ground before they seed. Such cutting will not disturb the stability of these areas and will give the native plants a chance to develop and successfully establish themselves. When noxious weeds must be controlled to protect agricultural land or because of local regulations, chemical or mechanical processes may be employed, but the landscape engineer must determine the most satisfactory process for his State or area and how far such eradication work should proceed.

8. It is most desirable that more consideration be given to general mowing practices. In a few of the States, such operations are under the direction of the landscape engineer, but in most States this work is a part of maintenance work and results are generally unsatisfactory. Even though careful collaboration may be had between the maintenance organization and the landscape engineer, serious mistakes are bound to happen. In other words, the landscape engineer can perform such work more satisfactorily and also at less expense so that a more natural and attractive roadside development will result.

9. Whether to use nursery-grown plant material or collected stock; whether to establish highway nurseries for the purpose of conserving surplus collected or nursery-grown material are questions which must be decided by each State. Where ordinary highway labor must be used it is believed that best results will be had from nursery-grown material. Where labor can be selected, and properly directed, collected stock can be handled successfully. Connecticut has established some half dozen small nurseries where native roadside material is conserved for future use. Pennsylvania has one large nursery of 102 acres, centrally located, where native material is conserved and propagated. However, great care should be observed in the establishment of such nurseries so that they do not compete with commercial growers and thereby antagonize these interests. Highway nurseries should be considered only as conservation or storage reservoirs for native material saved along the roadside, or for surplus nursery-grown material purchased commercially.In the case of Pennsylvania, the highway

nursery material is propagated at a cost of one-quarter of the lowest competitive bid from commercial nurseries, but it produces only about half of the planting material required.

10. The size and quality of planting material to be used cannot be standardized, but must be guided by the accepted and proper landscape practices for each State or locality, or by the special condition of the particular site. However, the standard specifications, procedure and nomenclature adopted and approved by the American Association of Nurserymen, which are usually followed by the corresponding State or local association, should be used in making up roadside planting plans.

11. Planting procedure with reference to technique in spacing, fertilization, top-soil, and other details cannot be standardized but must be determined by the landscape engineer for his locality or section. It might be well to emphasize the fact that initial plantings ought to be studied carefully so that they are as successful as possible. The general public is quick to notice planting failures along the highway and to criticize perhaps unjustly and without reason. Therefore, the proverbial "stitch in time" is most desirable and highly recommended as applied to general planting technique.

12. How much to expend for plants and planting is a variable factor and only broad generalizations can be given. According to general information given by the U. S. Bureau of Public Roads, from 60 to 75 per cent of the funds allocated may properly be expended for landscape treatment other than planting. Such work includes proper grading and laying back of slopes and fills and other necessary preliminary work. Proper grading back of slopes and fills ought to be a part of the construction work, as it now is in many of the States. However, in other States such work must be done as a part of the roadside development program and completed preparatory to planting operations. The extent of this work depends, of course, on many local and State factors. Wide rights of way usually assure better and more uniform procedure, while narrow rights of way necessarily limit the scope of such work. It is conceded that

> wider rights of way must eventually be secured to make possible adequate control of all roadside structures, especially at dangerous points such as road intersections, railroad and trolley crossings, the inside of curves and other points which present traffic hazards.

Planting and the choice of plant materials, as one of the factors in a well-rounded roadside development plan, are important enough to warrant close and careful study so that serious mistakes may be avoided. In this connection it will be advisable to consult with State or federal officials, colleges and similar interests concerned. Thus advantage may be taken of their advice and experience with reference to plant material, the suitability of the various soils for certain species, and the necessary artificial aids to be applied such as fertilizer, humus and similar materials.

It cannot be denied that Nature herself furnishes the best and most reliable guide, and if a genuine naturalistic planting is carried forward following this lead, the planting work will succeed. When those using the highways cannot determine what has been planted and what is natural; when it is impossible to differentiate between the man-created situations and the natural landscape, then roadside planting has achieved its ultimate goal -- then the whole roadside development blends naturally into the native landscape and has enhanced the charm of nature instead of diminishing it.

PLANT MATERIALS - DISCUSSION

It was pointed out that in general a 1 on 1 slope is entirely too steep for planting, and that it is futile to spend money trying to plant slopes that will not hold. There was general agreement that a 1 on 2 slope on uniform subsoil will support ground cover, but that for economical mowing operations a slope should be 1 on 3 or flatter. Some States have adopted the policy of planting ground covers or any slope steeper than 1 on 3 and grasses on flatter slopes. In a number of cases attention has been given to roadside development through the medium of planting without due emphasis on the fundamental principles of grading and stabilization of slopes.

There is an increasing need for an accurate definition of good roadside mowing operations. It was suggested that the ideal set-up would be first to eliminate the noxious weeds from the roadsides and then to maintain roadside areas in a condition similar to adjacent property.

A questionnaire might be distributed which would clear up this subject by producing ideal standards.

At the St. Louis Meeting there was considerable discussion with regard to mowing costs. Unfortunately no data are available to make any comparisons between the cost of maintaining roadsides before being graded and planted and after. This question arises continually in the attempt to answer the claims of some engineers that planting increases maintenance costs. The only answer to this charge would be for the States to keep more accurate records as a basis for cost comparison.

A discussion of mowing equipment revealed that there are several types of mowers in general use. Mr. Gubbels of Texas said that his State was developing an air pressure mower, and anyone interested was invited to correspond with the Texas State Highway Department.

It was reported that by the removal of guard rail mowing operations formerly done by hand could be carried on by machinery. The use of native sod, particularly in rural areas, naturalizes the roadsides and tends to eliminate some mowing operations.

A number of States experience difficulty in establishing locations for tree plantings due to public utility poles along the right of way. This brings out the need for more study of tree species with ultimate growth susceptible to proper clearance. It was further recommended that the Committee investigate existing tree laws for the purpose of eventually formulating an ideal standard covering this subject. This is particularly necessary now, due to the rural electrification program. One or more States have ruled that no pole lines could be constructed on new right of way or where poles did not exist at the time rural electrification was put into force.

The subject of divided highways* was discussed, and mention made of a 5,000 mile German road designed with a center strip. It was suggested that this new phase of highway development be given attention by the Committee on Plant Materials as well as the Committee on Highway Types and Roadside Areas. This Committee was in agreement that center strip planting should be dictated by simplicity and dignity, and by the type of the highway. The use of mass shrubbery was not recommended, especially in residential areas where youngsters might be induced to play on these islands, endangering their own lives and those of motorists. A certain amount of planting to prevent cross glare of headlights was cited as especially desirable.

Observation was made by Mr. Levandowsky that nature in time will cover our roadsides with native plant growth. More emphasis should be placed upon native material, therefore, rather than exotics, and it is better yet to encourage voluntary growth of proper species**.

Concerning types of plants, Mr. Ludwig recommended that studies be made of both naturalistic and formal plantings as they may serve to make traffic signs more effective and to eliminate guard rail. The use of formal tree plantings at intersections, on the outside of curves, at approaches to towns, and in front of school houses would portray to the motorist a more vivid picture of approaching traffic conditions than could be effected by signs.

Limiting formal planting to such areas and stressing the informal and naturalistic on all other sections of the road would eventually produce a psychological effect upon the motorist. Mr. Ludwig pointed out that different species may also be used to guide the driver, Pennsylvania having utilized white birch to indicate roadway limitations at night.

One phase of highway planting mentioned was the choice of trees and shrubs which will produce food for birds and wild life. The introduction of vines and thorny growths for the protection of wild life, as well as food producing plants, may sometime become a definite part of planting policy.

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*Reading Reference: "The First Thirty-Five Years' Experience in Modern Highway Building" by Sydney D. Waldon of Detroit, Chairman of the Committee on Roadside Development and Control, American Automobile Association.

**Reading Reference: "Roadside Ecology" by Professor F. A. Waugh, Massachusetts State College.

SUBCOMMITTEE No. 3 - URBAN ZONING

F. W. Sayers, State Highway Engineer, Chairman,
Missouri State Highway Department,
Jefferson City, Missouri.

1936 Personnel

Gries, Albin, Landscape Engineer, Illinois Division of Highways, Springfield, Illinois.

Hendrickson, C. I., Senior Agricultural Economist, Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

Massie, T. B., Landscape Engineer, State Highway Department, Tallahassee, Florida.

Rose, Franklin T., Landscape Architect, State Highway Commission, Topeka, Kansas.

Taylor, James H., Highway Landscape Supervisor, Department of Public Roads, Concord, Massachusetts.

Torkelson, M. W., Director of Regional Planning, Wisconsin State Planning Board, Madison, Wisconsin.

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NOTE: Following the November, 1936, Annual Meeting of the Highway Research Board Mr. M. W. Torkelson became Chairman of the Subcommittee on Urban Zoning.

THE STUDY OF URBAN ZONING AND ITS APPLICATION TO RURAL ZONING

An Outline Presented
By
F. W. Sayers, Subcommittee Chairman.

It has become evident that a roadway, traffic way or freeway is not only the area from ditch line to ditch line, but that the countryside through which the pavement runs is an integral part of the highway.

A highway should be looked at as being built not for the vehicle but for the passengers in the vehicle.

Factors to be considered:

Safety, convenience and comfort of travelers.

Economical transportation of goods and passengers.

Property values of adjacent lands.

Future expansion of roadway widths.

Sightliness and attractiveness of the roadsides.

Adequate right of way for effective roadside improvement.

Rural zoning as a means of controlling building lines, providing adequate right of way for present and future, and providing forest areas, agricultural areas, residential areas, and business areas.

Progress in rural zoning being made in some States

ZONING - DISCUSSION

With regard to the part which zoning must play in the proper development of the roadside, Mr. Sayers pointed out the need for an outline which would incorporate the purposes of this phase of the work. The Committee has made a survey of facts concerning zoning for highways, but for the purpose of developing a report there is need for a study relative to principles of zoning for highway purposes, and actual practice as already applied. There should also be an outline of definite research problems and a questionnaire by means of which every State could cooperate in furnishing data.

The Committee went on record as favoring comprehensive zoning acts for each region of each State, and enabling acts permitting set-back lines for future highway use. Rural zoning has made state-wide progress in California and Wisconsin, but in the knowledge of the Committee this progress has not been equaled in other States. A state-wide zoning act was recently defeated in the Missouri State Legislature, but this State is probably leading the way for the entire country in establishing a state-wide standard of 150-foot of right of way with 10-ft. shoulders. It was pointed out that the traffic surveys now being conducted by the States in cooperation with the U. S. Bureau of Public Roads will provide information upon which future zoning legislation may be based.

Chairman Neale requested that each of the members of the subcommittee present his ideas concerning the objectives of highway zoning. The opinions given emphasized the need for providing ordinances which would establish future widths for rights of way such as would allow proper planting and grading. At the same time it was noted that a minimum setback line should be established for the erection of buildings. Mr. Holley was of the opinion that the highway departments should have jurisdiction over unsightly areas such as automobile graveyards, and that they should be able to control the size and position of billboards. Billboards in Indiana can be placed only where the highway commission designates. Mr. Sayers mentioned the fact that Missouri has a law prohibiting the establishment of junk yards along highways, and requiring such sites to be concealed by high-board fences.

As justification for rural zoning ordinances Mr. Stellhorn noted the need for adequate right of way depending on immediate and future traffic requirements, preservation of natural scenery, and the prevention of commercial encroachment; also the necessity of determining locations for scenic parkways and suburban approaches. Professor Elwood expressed the matter in terms of the preservation of established values: the highway investment, the natural scenic beauty of the region, and the economic development of the adjacent land in accordance with a comprehensive zoning plan. He also stated his belief that city ordinances should prevail beyond the city limits, since the worst abuses are at the edges of cities.

SUBCOMMITTEE No. 4 - HIGHWAY TYPES AND ROADSIDE AREAS

H. J. Neale, Landscape Engineer, Chairman,
Virginia Department of Highways,
Richmond, Virginia.

1936 Personnel

Bowen, Grant R., Landscape Engineer, State Road Commission, Salt Lake City, Utah.

Gubbels, Jac. L., Landscape Architect, State Highway Department, Austin, Texas.

Hall, J. M., Landscape Engineer, Iowa State Highway Commission, Ames, Iowa.

Massie, T. B., Landscape Engineer, State Highway Department, Tallahassee, Florida.

* * *

No report was presented.

SUBCOMMITTEE No. 5 - EDUCATION AND PUBLIC RELATIONS

Professor P. H. Elwood, Chairman,
Iowa State College,
Ames, Iowa.

No Personnel

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REPORT OF SUBCOMMITTEE
ON
EDUCATION AND PUBLIC RELATIONS

By

P. H. Elwood, Chairman,

Educational Standards.

Looking toward the future and anticipating an adequate and stable nation-wide roadside program on a permanent basis, we should set up educational standards that will insure the continued growth and improvement in character of the work in every State of the Union.

It is realized fully that we cannot or should not attempt to standardize the personalities or stifle the individuality of the landscape architects or engineers engaged in roadside development work in the future. However, there are certain minimum educational requirements that must be established if the high purposes and objectives motivating the officials of the Bureau of Public Roads are to be achieved.

Perhaps the direct question is the best way to approach this problem. Let us consider a few obvious queries on the educational requirements for the planners and directors of the future roadsides of America.

What is the best professional training for this work? The very best and broadest possible foundation is essential. Problems in this special landscape field involve not only technique but also an understanding of the fundamentals of engineering, architecture, botany, ecology, horticulture, pathology, entomology, soils, crops, and simple hydraulics. Such knowledge is required for successful collaborative work with other technicians in the great highway building and maintenance program of the country. The directors of this new field of work must be in a way natural diplomats and psychologists to deal successfully with an uninformed or misinformed public and technical staff. This is so important that often the more successful work is done by those lucky individuals endowed by nature with this priceless treasure, the ability to work happily and successfully with others, even though of quite different backgrounds and trained in opposite schools of thought.

After generations railroad cross sections in highway design and wanton waste of forests, soil and other natural resources, it is too much to expect immediate success for any progressive movement. It would be dangerous to change directions and practices too abruptly. So let us be patient and not too easily discouraged with the results being obtained by many untrained and ill-prepared men who are no doubt doing the very best with their limited resources.

Following up our statement concerning the need for a broad training in the various fundamental subjects, this should be accompanied or climaxed by a thorough professional college degree course in landscape architecture. This will require from 4 to 6 years of collegiate training. In this field of endeavor for trained landscape practitioners, in selecting elective courses greater emphasis probably should be placed on the fundamental or basic sciences and engineering rather than social science, literature and art.

Some of our friends from time to time have advocated a special four-year college curriculum for highway landscape architects to be offered at several of the leading schools of landscape architecture. With this the Committee thoroughly disapproves. Highway landscape architecture or engineering is simply one type or phase of the broad professional practices of the landscape architect. We should encourage more uniformity in the titles of the men in charge of this important work.

Consulting Services Suggested.

In many States where important scenic highways, freeways, and parkways are to be developed, the advice and service of a landscape architect widely experienced in such problems should be obtained, the better to coordinate the work of other government agencies. Through this coordination the field men themselves would be greatly benefitted, their own point of view broadened, and their educational equipment strengthened.

Where can such preparation be obtained?

There are nine member schools in the Association of Professional Schools of Landscape Architecture in this country and about as many more offering degrees in landscape architecture or, as it was formerly called, landscape gardening. Some of these last mentioned schools offer excellent preparation from an horticultural and engineering standpoint. Graduates from these institutions are very adaptable to this work and fit at once into harmonious relationships with their technical associates. However, for original design, collaboration and direction, the more thorough professional training should be encouraged. At best, the present output of all these schools is woefully inadequate to supply this demand in addition to the many calls from the other great governmental planning agencies during recent years. This demand may not be so great in the future. That depends somewhat on the quality of work accomplished and the soundness of the plans prepared. The sudden call and the inadequate supply of professionally trained men for the inauguration of this work on a nation-wide scale has made it necessary to employ men with little or no special training or experience. Some of these men are laboring under the delusion that they have such training due to an utterly dishonest and unfair attitude on the part of many institutions offering superficial appreciation and elementary introductory courses under high sounding titles which lure the student.

This sort of educational hypocrisy must be stopped if high standards of highway collaborative planning is to be accomplished. Well-trained engineering and construction men soon detect the sham and lose respect for the whole program. Appalling mistakes are made and the public in turn becomes lukewarm or actually antagonistic.

The members of this subcommittee feel therefore that the future success of the roadside development work depends to a great extent on the educational background and qualifications of the men employed to plan, direct, and carry out the work. It is not our function to lay down any special curriculum, but to point toward better and more thoroughly trained men from acceptable schools.

In this connection we wish to suggest further study of the schools by this Committee and the establishment of much more rigid educational requirements before men are employed by the various States as landscape architects or engineers. The permanence of this great forward step in highway design depends on firm and perhaps in some cases drastic action, and a strict maintenance of higher and higher standards of educational requirements.

As for the educational improvement of the able though sometimes inadequately trained men actively engaged in roadside work, this question offers tremendous possibilities and suggests many different answers. Of course, there will be as many suggested procedures as there are individuals, since background, training and experience, as well as personal tastes and abilities, all differ.

Self Analysis: First Step in Self Training.

Each and every man should subject himself to a severe analysis. An intelligent man is his own best critic. For this the individual should be advised by a more experienced and well-trained successful practitioner. This preliminary process might be called a sort of technical or professional clinic.

Reading and Study Most Valuable.

A system or course of selected readings from the material prepared and presented by this Committee would be the next step. This list should include those basic fundamentals which are lacking, or the technical work of engineering, agriculture, landscape architecture or architecture of which the individual himself feels the greatest need.

Travel and Observation.

Travel and observation of actual and reputable work elsewhere will be found most valuable. Every highway commission should make such project study possible for all its chief landscape engineers and assistants.

The third step might be attendance at one of the proposed short courses or regional schools. The order or sequence of these last items may be reversed.

Another step, when possible, would be a leave of absence for a year (more or less) for special study at one of the best schools to round out the special training or fill in gaps in background work in collaborative subjects.

Keep stepping and in step all the time by availing oneself of every opportunity for self improvement by observation, contacts, lectures, conferences and study. Each State group might organize their own reading and conference study groups when federal inspectors or professionals from neighboring States might assist.

Extension of Inspection Service.

It has been suggested by some that the U. S. Bureau of Public Roads should very soon and very widely extend its inspection service. Furthermore, a much more rigid set of requirements should now be established. After all, the best and only way to raise standards is to raise them by higher requirements for acceptance of projects. Let us not shut our eyes to this immediate need. The good work and high standards of the majority must not be jeopardized by the gross shortcomings of a few.

Good Work Best Public Educator.

This brings us to the problem of public relations. As above stated, high quality work accomplished is the very best means of educating the public to the value of our work. However, new work often is not as conclusive as a demonstration of the ultimate good to be accomplished or the many beneficial results involved. Much of this is hidden from view and needs interpretation and explanation by those who know. Therefore, a series of illustrated articles or pamphlets for wide distribution and circulation should be prepared by the designer in charge of each State. These newsstories should be used by the Sunday press, giving State-wide and national distribution. Many popular and technical magazines value such articles and would, we believe, publish many more if furnished the material.

THE LITERATURE OF ROADSIDE DEVELOPMENT AND AN IMMEDIATE PROGRAM BY THE COMMITTEE ON EDUCATION AND PUBLIC RELATIONS

1. A bibliography on this subject and contributory material to be prepared for general distribution. (See accompanying bibliography).

2. An outline of suggested supplementary study and reading for roadside landscape architects. (A more or less technical bibliography).

3. A series of Roadside Development short courses or conferences, the first perhaps to be held at Ames, Iowa, in February, 1937. The purpose of these short courses and conferences would be twofold: First, to give definite practical instruction to technical men. Second, to serve as a means of cooperation with state roadside councils and garden clubs and other lay groups interested in better roadsides. These organizations are entitled to know the details and purposes of the roadside program so they may help more effectively in building up strong public demand and support.

4. A proposed syllabus or manual of photographs, plans, details and discussions from various State highway landscape engineers.

5. A series of mimeographed lectures or outlines on:

   a. Principles of design and ecological studies in roadside development. Selective cutting and trimming; replacements and supplementary planting. Planting composition and character in planting.

   b. Cross sections and their relation to design and use. Slope and bank protection, including drainage and erosion control.

   c. Snow and its control.

   d. Soil, seed and fertilizer problems and their solution.

   e. Maintenance of new plantings and seedings. Insect and pest problems.

   f. Roadsides of the future. Zoning, right of way widths, location and general principles of modern roadside improvement.

   g. Waysides and stopsides and their development.

   h. Operation, financing and management of projects. Cost data, records, standard construction and nomenclature.

   i. Official film strips from U. S. Bureau of Public Roads for circulation in various regions. Photos and slide lecture material from many States.

6. All or a condensed edited review of this material under item five to be published in book form by the National Research Council or Commercial publishing house. This could be used as a text or reference work in connection with short or special courses on roadside development in the technical schools.

7. A series of descriptive illustrated articles to be prepared by the landscape engineer in charge and published in State and national press as well as popular and technical magazines. Much of this has been done with splendid results.

Conclusion

No doubt many other steps will need to be taken in the rapid forward movement toward finer, better designed, safer and more beautiful highways in America, but the Committee on Education and Public Relations of the Joint Committee on Roadside Development feels that here are some important guide posts which, if realized, may mark well the way toward the final objective when American highways will indeed be comparable and worthy of the high civilization and the incomparable scenic beauty and natural resources of our country.

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THE COUNTRY ROADSIDE RESTORED

A film strip presented
at the
Washington, D. C., Meeting

The purposes of this film are several:

(1) To present a brief pictorial survey of current highway problems to interested non-technical organizations such as garden clubs, civic clubs and the like.

(2) To point out the chief obstacles to the preservation and restoration of country roadsides and to illustrate how the highway engineer may be able to solve them.

(3) To emphasize the value of public cooperation in obtaining proper development of the highway.

Experience has taught that we should use as our highway landscaping model not the private garden but the natural beauty of the old country roadside. Private land development is so limited that its problems seldom correspond to the large-scale problems met with in roadside landscaping. Traffic speeds make it impossible for the motorist to see or appreciate garden types of development. By studying the extreme simplicity of nature's methods we may best learn to produce attractive roadsides susceptible to economical maintenance.

The pictures in this film illustrated the sequence in highway building beginning with the old dirt highway which looked so attractive in every way, although they were not suitable for automobiles. Next came the rebuilding of these roads to carry modern traffic with construction scars spoiling natural beauty because there was neither time nor money to do anything but lay the pavement. Methods were then illustrated by which the highway landscape can be restored and preserved*.

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*This film-strip series may be purchased at a reasonable price by writing to the Division of Cooperative Extension, Extension Service, U. S. Department of Agriculture, Washington, D. C. A projector may be borrowed from your local motor-distributing agency.

EDUCATION AND PUBLIC RELATIONS - DISCUSSION

The work of this Subcommittee is closely related to all other Subcommittees in that it includes such problems as:

1. Preparing and distributing data of educational importance to the public.
2. Preparing and outlining study for men actively engaged in field operations in order that there may be more uniformity of practices throughout the country.
3. Furnishing information regarding uniform practices and telling what roadside development means and what it should accomplish not only in esthetic but utilitarian and economic lines.

The discussion brought out the following factors:

More emphasis should be placed on educational work within the highway departments, not limiting it to the roadside development forces. It is highly advantageous for men in the field to attend a school of instruction and to study current literature on landscape subjects. If this Subcommittee can outline a course of study with references to collaterial reading it is felt that more could be accomplished in a practical manner.

Mr. Kendall of ROADS AND STREETS stated that he visited twenty-two State highway departments during the past summer and was disappointed to find a general lack of knowledge concerning the advantages of good roadsides by both maintenance and construction engineers. He urged that education of each sub-division of each State highway department begin immediately.

Mr. Nichols suggested that all schools and universities should include roadside development practices in their curricula, particularly engineering and forestry schools.

Mr. McClain, Maintenance Engineer of Indiana, suggested that the Subcommittee prepare a glossary of terms for roadside beautification, roadside development, etc., such as are being used by maintenance engineers. He stated that if proper nomenclature could be decided upon, maintenance men and engineers would be glad to accept these as standard.

Professor P. H. Elwood reported on a proposed Manual of Roadside Development. It was the opinion of the Subcommittee that the preparation of such a Manual was the most important single work which could be initiated at this time.

1. The purposes of the manual would be:

   The assembling of the best available information regarding present methods of roadside landscape development.

   The making of this information available to design, construction and landscape engineers at the earliest possible date, consistent with preparation of an authentic manual.

   The securing of the cooperation of highway departments, civic leaders and the general public in roadside development as an integral part of highway programs.

2. The form of the manual to be divided into 2 specific types of publication -

   A Pictorial Portfolio with photographs, general technical plans and diagrams.

   A Loose Leaf Manual for use of field men, revisions and additions to be made to keep manual up to date. Particular mention was made of the recent National Park Service Manual - "Park Structures and Facilities" as a model for the first type of Manual on Roadside Development.

3. The manual to be published by:

   The Highway Research Board, or by cooperation between the Board and such agencies as the Carnegie Institute.

4. Necessary information to be collected by:

   Individual State highway departments in cooperation with the Bureau of Public Roads, the Soil Conservation Service, the Carnegie Institute, and similar agencies.

MISCELLANEOUS DISCUSSION

PLANS AND ACCOUNTS

The question of modification of plan presentation methods and the use of unit cost measurements comparable to those of highway construction plans were considered. Mr. Simonson emphasized the importance of research, and the fact that roadside improvement work progresses as a series of demonstration projects, each having research value when applied to the problems which follow. These plans will establish clear justification for each item of work and for each dollar spent. Complicated lists of plant materials and complicated specifications lead to involved and costly plans and field procedure.

A stage construction method of roadside development appears to open the way for coordination of landscape improvement with highway construction activities. A particularly important opportunity for coordination lies in the possibility of combining non-seasonal landscape operations (basic grading, salvage and restoration of topsoil, etc.) with regular construction operations, a process which simplifies landscaping and reduces its cost.

Mr. Gordon stated that a satisfactory plan will indicate all existing conditions of topography, soil, and vegetation which have a bearing on landscape development, and will reveal those stages of the work which need to be performed. It will clarify the reasons for each unit of each type of work, and the manner in which it is to be done. Essential information will be simple yet complete, but for economy all non-essentials will be reduced to a minimum.

Mr. Sayers remarked that Missouri is working up a plan presentation which will be a clear guide not only to the planting foreman in the field, but also to the cost accountant in the office.

SNOW DRIFTING*

The value of natural (planted) snow fences in connection with the snow drift problem must be developed through demonstration projects. In the snow belt the landscape engineer must guard against the possibility that plantings may cause increased drifting on the highways. It is also important to determine the distance plantings should be kept from the roadbed so that proper widths of easement may be obtained.

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*See: "Effect of Trees on Wind Velocity", by Franz Aust, Proceedings, Highway Research Board, Vol. 15, p.112.
"Snow Control by Tree Planting", by E. A. Finney, Proceedings, Highway Research Board, Vol. 16, p.119.

SAFETY

From the physical standpoint, the value of such safety measures as the removal of dangerous obstacles, the widening of shoulders, flattening of slopes and the elimination of deep ditches is generally recognized. But in addition to measures of this type, there are certain psychological considerations of importance in promoting safety. A pleasant environment for travel is mentally restful to the driver. The elimination of physical disorder and the provision of well organized landscapes tend to minimize mental confusion. Mr. Gubbels of Texas described how his State found that a raised landscape prevented confusion at a dangerous rotary intersection, eliminating accidents entirely. The Committee expressed the desire to be informed in the future of any such observations of improved safety through the application of landscape design principles.

Mr. Lamb of the National Park Service called attention to the fact that plantings and views should be so arranged that the driver can seem them through the windshield, as he approaches, rather than through the side window. Objects of interest, moreover, should be spaced at sufficient intervals to allow the motorist to comprehend what he is looking at. Most of us require 5, 6, or even 10 seconds to gain a definite impression of what we see, and by that time our car may have advanced a tenth of a mile.

POLE LINES

Pole lines were discussed with reference to right of way widths, interference with tree planting, the need for trimming and pruning permits, and the various State laws concerning the utility pole question. Tree plantings along the highway are considerably handicapped where pole lines are numerous, and the problem is particularly acute on the 80 ft. right of ways in Indiana. To illustrate, on 80 ft. right of ways in Virginia poles are placed 2 ft. and trees 13 ft. from the right of way line. The new rural electrification program is rapidly increasing the pole line problem in North Carolina and in the rural sections of several midwest States. Such rapid installation of heavy power lines is likely to cause considerable damage to the trees, in the absence of restraint by regulation or reasonable regard for tree values. The use of cable to replace wires, and even underground conduits, may be encouraged in some instances.

The Highway Commission in Virginia has ruled that no poles may be put on new locations unless the old road has been abandoned.

MAIL BOXES AND NEWSPAPER CONTAINERS

The question was brought up as to what the States are doing about the problem of mail boxes and newspaper containers placed on the shoulders when their presence interferes with maintenance (mowing) operations. In Virginia the highway department may move anything which interferes with such operations, and in some cases mail and paper boxes have been placed on the same standards without objection. Mr. Sayers stated that newspaper containers were disappearing from use in Missouri, and did not constitute a serious problem there. In Texas the highway department does not allow newspaper names to appear on boxes, since advertising is prohibited on the highway, and this policy has reduced the problem in that State. Texas mail boxes have been improved in design by use of a uniform standard straight post placed in a block of concrete so that maintenance men may take them up and set them aside, replacing them after maintenance operations. In Iowa old guard rail posts removed during landscape grading operations are used where necessary as mail box supports, painted with standard white guard rail paint and later maintained by the department.

In conclusion Mr. Simonson pointed out that the Post Office regulations require clean painted mail boxes which none but the mail carrier and owner shall tamper with. Therefore newspaper containers should not be attached as a unit. It is required that mail boxes be on the carrier's right-hand side of the road. The Post Office Department will cooperate in any reasonable effort to improve the appearance of the roadsides that is in conformity with its general regulations.

JOINT MEETING OF COMMITTEES
ON
DESIGN, MAINTENANCE AND ROADSIDE DEVELOPMENT
HIGHWAY RESEARCH BOARD

Washington, D. C., November 18, 1936.

DESIGN AND USE OF SHOULDERS, DITCHES AND BACK SLOPES ON HIGHWAYS

By
C. N. Conner, Bureau of Public Roads, Chairman,
Department of Design, Highway Research Board

The utility, safety and appearance of a highway depend in no small measure on the design and maintenance of its shoulders, ditches and back slopes. When poorly designed or inadequately maintained, shoulders and ditches account for irreconcilable maintenance costs and a shockingly large number of accidents. It is possible and practicable to make designs that will reduce the number of severity of traffic accidents and definitely cut maintenance costs. A review of recent statements by highway authorities, examination of current designs of State highway departments, and a glance at some 2,000 maintenance reports show clearly enough the inadequacy of most old designs for modern traffic. Now is the time to review and appraise design practices and to follow those trends and objectives which lead to greater traffic safety. Present traffic is fast, future traffic will be faster - speeds up to 100 miles per hour may be expected. This fact cannot be lightly set aside. We must meet the situation squarely by designing new roads and reconstructing old roads to serve this traffic and reduce the number of fatalities. It is estimated that approximately 30 per cent of all highway fatalities may be attributed to design and location. Soft shoulders, deep ditches and narrow culvert headwalls are the direct cause of many accidents.

Let us examine with critical eye the designs of a few years ago, current practice, and trends in the design of modern two-lane highways. The average two-lane highway on State highway systems expected to carry up to 4,000 or 5,000 vehicles daily has a width out to out of shoulders, of from 30 to 36 ft. Most of the older designs and many of the modern ones show a width of 30 or 32 ft. The pavement width on these sections varies from 18 to 24 ft. Most current designs have a 20 ft. pavement, and there is a definite trend toward a width of 22 ft. The shoulder width on these sections appears to have been fixed at whatever distance remained after the pavement had been accommodated.

Right of Way. Except for a few unhappy property owners, no one questions the need for right of way sufficient to accommodate generously construction requirements. Too little, however, is being done to obtain wide rights of way. In the past roadways have been largely limited to those dimensions which could be constructed within minimum right of way limits, with too much stress on saving money and too little regard for saving life. Although recognizing that wide right of ways are desirable to inclose roads designed for modern traffic, too few highway authorities have definitely determined to obtain adequate right of ways. We cannot reasonably expect to reduce accidents without providing areas sufficiently large to contain safe highways.

Shoulders. In the past we have said that the purpose of shoulders was to provide parking space for broken-down vehicles and we built thousands of miles of relatively wide shoulders with that thought in mind. Actually, however, modern vehicles are less subject to breakdowns than formerly and the need for parking on shoulders to make repairs is greatly reduced. It is, of course, still necessary to keep the occasionally parked vehicle off the pavement and outside a point 10 ft. or so from the center line of the road. Commendable efforts are being made to provide extra shoulder width at rural mail boxes, bus stops, and special parking areas just off the road where scenery may be viewed without obstructing traffic. Shoulders, however, have two other important functions; first, that of protecting the pavement from damage by water and melting snow, and second, that of providing an all-weather waterproof surface for vehicles in motion which have been forced off the pavement surface.

The width of shoulder on most existing roads has been fixed by the width of grading and width of pavement. Some roads have pavements 18 ft. wide and shoulders 7 ft. wide, others have 20 ft. pavements and shoulders 5 or 6 ft. wide. It is apparent that roads already graded to a width of 30 ft. and paved to a width of 18 ft., having waterproofed shoulders 6 ft. or less in width, are less hazardous to traffic and less liable to damage than roads having pavement 20 ft. wide and earth or grass shoulders 8 ft. or more in width. A desirable section for a modern two-lane highway would be one having a paved width of 22 ft. and gravel, stone or slag shoulders, bituminous treated, having a width of 8 ft. Such construction, however, is necessary only on two-lane roads carrying or likely to carry traffic relatively heavy in weight and large in volume.

Materials commonly used in shoulders are those available locally, which, in too many cases, means ordinary earth. Other materials such as gravel, stone and caliche, when available, are used extensively to good advantage. For best traffic service and lowest maintenance costs, shoulders of granular material should be improved with a low-cost bituminous surface 1 to 4 in. deep, depending on the amount and weight of traffic likely to use them. Grass or sodded shoulders on heavily traveled roads, particularly those of inadequate pavement width, cannot be maintained in a satisfactory manner at reasonable cost because traffic prevents the growth of grass and cuts the shoulders extensively. It is advisable, therefore, to consider the use of grass or sodded shoulders only where traffic is relatively small in volume and where there are few buses or wide trucks likely to run off the pavement. Grass shoulders, although attractive in appearance, are dangerous when wet or soft. Ordinary earth shoulders, when rutted and eroded at the pavement edge, are particularly hazardous. Damage to the best of pavements is sure to result from water entering ruts and percolating beneath the pavement. Shoulders constructed of gravel, slag or crushed stone are greatly superior to those of grass or earth. However, they become dusty or eroded and relatively expensive to maintain when flanking pavements of inadequate width. Best of all are shoulders treated with bituminous materials. They should be used without hesitation to protect traffic and pavement until a more substantial widening is needed. If funds are not available for waterproofing the full width of shoulder a relatively narrow transition strip of a low-cost bituminous mixture at the edge of a too narrow pavement will greatly reduce maintenance costs and accidents. Snow removal is facilitated where shoulders have been treated with bituminous materials, and maintenance reports show definitely that shoulders of this character protect the adjacent pavement against the disastrous effects of freezing and thawing. Extensive pavement failures and fatal accidents may be traced directly to low and rutted shoulders. Lean and skimpy designs are responsible for a large number of highway accidents. Many of them could have been prevented by generous sections calling for wide bituminous treated shoulders, long culverts, and wide bridges.

Ditches. All roads should have adequate cross drainage and adequate side drainage. Intercepting ditches and berm ditches should be constructed outside the tops of cuts, particularly in rolling and mountainous country, to prevent surface water from eroding back slopes and entering and overflowing side ditches. Drainage ditches leading from the roadway should be constructed in flat country to remove water quickly from the vicinity of the highway. All ditches or gutters should, of course, have sufficient slope to carry the run-off water without erosion. On steep grades, and in light soils on any grade, erosion may be prevented by numerous well-known means such as paved gutters, ditch checks of stone, timber or other materials, and plenty of pipe culverts under the road. Pipe placed below shallow side ditches parallel to roadways are used with success instead of deep ditches. Although relatively expensive as compared with open ditches, they definitely reduce traffic hazards and provide adequate drainage at reduced maintenance costs. They may be the best solution to drainage problems resulting from inadequate right of way.

Present practice shows a definite trend toward the use of wider and shallower ditches or gutters rounded at shoulders on the inside of the road, at flow line of the ditch, and at slopes of cuts.

Back Slopes. Until recently the rates of slope on back slopes in cut, and side slopes in fill, have been the steepest that reasonably would resist the action of the elements. Little thought had been given to their effect on highway safety. Cuts were commonly sloped at the rate of 1 to 1 or 1½ to 1, fills at 1½ to 1 or 2 to 1. Except in rare instances little thought was given to rounding or flattening slopes so as to reduce erosion or to sloping low fills gently to increase highway safety. Briefly stated, past practice in too many cases called for grading which would provide highway facilities quickly at minimum cost without due regard to traffic safety. These old designs, suitable perhaps for the needs of the past, are responsible for many present day accidents and high maintenance costs.

Current practice and present trends show slopes in some cuts and most fills to be rounded and flatter than formerly. It is usual for shallow fills 5 ft. and less in height to have side slopes of 4 to 1 or flatter. On the other hand, in mountainous country involving heavy side hill cuts, shoulders and ditches are sometimes omitted entirely and an extra width of pavement with a paved gutter or curb is used instead. Grading costs are greatly reduced thereby. In flat or gently rolling country, sections are being constructed which call for the use of extra wide fills having flat side slopes, instead of relatively narrow fills with steep side slopes and guard rail, especially where fills are long.

No discussion of the subject would be complete without consideration of the utility of lip curb in pavements. The Mississippi Valley Conference at a recent meeting did not come to definite agreement on this matter. Some of the engineers present believed lip curbs should be used practically everywhere. Others believed they should be used only where there is a substantial flow of water along the road to prevent ruts caused by running water. It is believed by some that lip curbs reduce the effective travel width by about one foot on each side of the pavement. Lip curbs decrease the possibility that water from shoulders will seep laterally under a pavement, but they increase the possibility of seepage to the subgrade through pavement joints because the pavement carries more water on its surface when lip curbs are used than when they are not. There is also a possibility of water ponding on the surface of the pavement when side outlets through the lips to ditches are not properly designed.

More than 20 years have elapsed since Upham obtained minimum 100 foot right of ways for the original two-lane Dupont Road in Delaware, graded it to a width of 32 ft. out to out of shoulders, placed all culvert headwalls 32 ft. in the clear, sloped fills under 5 ft. in height at the rate of 3 or 4 to 1, drained swamps, built wide shoulders and shallow ditches, concealed and drained all borrow pits, planted trees and grass along the roadside and by-passed towns. That practice is still good.

DITCHES, SHOULDERS AND BACK SLOPES

By

James E. Lawrence,
Maintenance Engineer,
Massachusetts Department of Public Works

A discussion of any item of highway maintenance requires an understanding of the fundamental conditions which control the procedure to be followed, or standards to be adopted. Local factors indicate that certain details should be adopted which may or may not be controlling factors in other locations. The current practices in Massachusetts highway maintenance are the result of experience and analyses of general and specific conditions.

Ditches. Deep side ditches, parallel with the roadway, have nearly all been eliminated from State highways in Massachusetts. This development has resulted from the logical requirements characteristic of high speed and heavy traffic routes: that hazards should be eliminated and that traffic lanes should be provided with a safety strip as emergency leeway in acute driving conditions rather than a ditch which would cause overturning.

This requirement therefore necessitates the construction of underdrains to take care of surface water drainage. Also, certain locations have required a system of underdrains for the purpose of lowering the ground water level, and to prevent ground water from adjacent banks and higher levels from entering the sub-base. These drains consists of perforated corrugated iron or vitrified clay pipe, laid with open joints in trenches which are then filled with a pervious material, such as broken stone or gravel. The surface of the back fill is then sealed with a bituminous material in order to prevent silt or other fine material from filling the drain.

On some of the highways in the western part of the State, where traffic volumes are comparatively small, side ditches have been constructed. These, however, are formed with a 4 to 1 slope which extends from the shoulder of the road out to the back slope, the bottom of this ditch being at the same grade as the bottom of the sub-base, which is generally 18 in. below the grade of the shoulder. This design has the advantage of preventing stones and material, loosened from the slope by erosion or frost action, from falling upon the roadway. This widened area is also of considerable benefit in winter maintenance because it provides a place where snow may be disposed of in the plowing operations.

Shoulders. The shoulders are usually constructed of gravel about 3 to 5 ft. wide and 6 in. deep, and should be low enough to allow water to run off the pavement.

On the heavily traveled highways these shoulders are treated with about 1/3 gal. of slow-curing asphaltic oil of from 20 to 40 viscosity, and with the asphalt content, at 100 penetration, of from 45 to 55. In other locations a low viscosity tar and calcium chloride are applied to the shoulders. The shoulders are then dragged at various times throughout the year, and on the heavy traffic highways they are dragged as often as once a week.

On steep grades, to prevent erosion, the gravel shoulder is eliminated and the pavement section widened to the foot of the slope or to the grass line. From the standpoint of safety and appearance it is important that the soft shoulder receive proper maintenance. However, since this maintenance is costly, on heavily traveled highways the shoulder may be hardened with base and sub-base of the same design as the pavement section. While the first cost may be high, the final cost, which includes the upkeep, undoubtedly will be lower, and the result will be a safer and more pleasing highway.

Back Slopes. The most serious maintenance problem of back slopes is erosion. The accumulation of water on the top of the slope should be diverted by means of a ditch parallel with the top of the slope. Where necessary to dispose of such water down the face of a cut or embankment, paved gutters or underdrains are used.

The treatment of each slope, however, is a special problem, depending on such factors as type of subsoil, presence of underground water, location, cost, etc. Thus the conventional $1\frac{1}{2}$ to 1 slope, where fine sand is encountered, may be changed to the 2 to 1 slope, and where funds are available it may be sodded, or loamed and seeded. Partial success in wet clay slopes has been obtained by the planting of willows. In some cases underdrains are being installed to intercept the underground water before it lubricates and softens the subsoil.

In Palmer there is a slope, 100 feet in height which has caused a great deal of trouble. The subsoil is composed of clay and fine sand which, on becoming wet in the spring, has caused landslides that have partially blocked the highway. At the present time this slope is being terraced and sodded in order to prevent the downward wash. Also, an extensive system of underdrains and inlets from the terraces is being installed to take care of both surface and ground water.

The maintenance of slopes involves not only the attainment of conditions necessary to prevent loose material from falling to the roadway, or the gradual filling of drainage ditches at the foot of the slopes, but also the desirable effort to keep the roadsides neat and free from crude conditions. The endeavor is made to trim the top of a slope where the slope line intersects the original surface, in order to prevent the unsightly appearance of an over-hanging top soil. This is generally accomplished by rounding off the top of the cut with a vertical curve. A similar curve is often made at the foot of a slope. These details should be included as standard in the design for highways.

There are many maintenance details which have become standard. The effort is made to adhere to such ideals, but the performance may not be equal to the standard established. Physical conditions are often the factors which prevent attainment of this goal.

SAFETY FEATURES OF ROADSIDE DEVELOPMENT

By

Frank T. Sheets, Consulting Engineer,
Formerly Chief Engineer, Illinois Division of Highways

The subject of roadside safety features was discussed by Mr. Sheets. One of the most important questions was said to be that of shoulder treatment. How wide should the shoulder be, and how wide the ditch. Narrow shoulders constitute one of the greatest hazards that we have ever made, and it appears that we should resolve to build no more of them except on roads of a definitely local character, or none which are not at least one full traffic lane in width. Another special hazard is the building of canyons beside the shoulders in the form of so-called drainage ditches. It seems that we should not only go in for flat slopes from the edges of the shoulders to the ditch line, but further that we need to eliminate the deep ditches that have often been constructed in the past. It is difficult to understand why a ditch has to be any deeper than is required to take care of surface water. One of the greatest things we can do is to build shoulders of ample width, generally not less than one traffic lane wide, not more than 4 to 1 in slope and then not build the ditch any deeper than we must.

Another safety feature concerns pavement crown. This may not be roadside work, but it is an important matter to take care of the drainage on the pavement itself, to get the water into the ditch. Among other things, water left on the pavement and allowed to freeze creates the additional problem of ice removal and skidding hazards.

Another consideration is that we have made a considerable number of guesses and estimates about highway design, and after surveying the fruits of our labor we realize the fact that we did a lot more than the public wanted us to do. We should plant so as not to interfere with sight distances and safety. And while we are considering where we should put the trees and shrubbery, we might at the same time consider where not to put the billboards.

Ten years from now we will probably all recognize the fact that in addition to the regular surfaced area we must provide an emergency roadway in the form of a stabilized shoulder which remains travelable in all seasons of the year.

EROSION

By
O. L. Kipp, Construction Engineer,
Minnesota Department of Highways

Erosion is an age-old landscape-forming factor, the effect of air or water in motion on the earth's surface. A brief discussion of such a universal factor must, of necessity, ignore many of its interesting and important phases, while those mentioned can only be suggested or briefly analyzed.

Through the ages, particularly in glaciated areas, erosion has contributed largely to the formation of the present topography. From even a casual study it is evident that enormous factors, both of time and of volume of water, have been involved in carving out the enormous valleys and the lesser tributaries reaching out in diminishing size but with increasing numbers to form our natural drainage systems.

Prior to the arrival of civilized man in this country, nature had developed a protective ground surface cover of grass, brush, shrubs and trees, which, generally speaking, had reduced erosion to a minimum. These, through their soil-binding qualities, more than offset the soil-depleting force of erosion in all but the steepest non-agricultural areas.

The full enjoyment of our natural resources demands that the balance thus established be maintained. However, from the advent of civilized man, with his extensive uncontrolled agricultural methods and his removal of timber growth, these natural protective agencies have been destroyed so extensively in many regions that damage from erosion has become a problem of serious public concern. This problem has too long been neglected because of ignorance or willful intent to skim the cream of our natural resources, leaving only the blue milk of depleted soils and eroded slopes for posterity.

Highway engineers and those with greater administrative perogatives, in determining the methods and policies of highway location, design, construction and maintenance, have been flagrant violators of public interest in aiding and abetting this public enemy erosion. Until recent years highways have been located, designed and constructed almost universally without regard for the rapidity with which steep mathamatically accurate and regular slopes, finished with painstaking care, lose their highly artificial shape and "sandpaper finish" through erosion. To the discredit of highway officials the waste and economic futility of this procedure, with its unwarranted desecration of the natural beauty of the landscape, is often rather grudgingly admitted under pressure of popular demand for roadside development and erosion control.

Highway officials and engineers must have the breadth of vision necessary to work wholeheartedly with competent broad-minded landscape architects in realigning policy and procedure relating to highway location, design, construction and maintenance. Suitable provision in highway location and design for avoiding erosion difficulties where possible and for protection against erosion when necessary will fulfill, to a large degree, the major requirements of roadside development in the initial construction. With such landscape design recognized at the outset, roadside development as now applied to existing highway construction is superfluous and unnecessary. The avoidance and prevention of erosion difficulties produced by highway construction, therefore, have an enormous esthetic and economic value.

Apparently the popular press and technical publications have thus far dealt with erosion largely as an isolated problem, without mention of its "Siamese Twin", the problem of "silting". The wastage of farm land and the destruction of expensively prepared highway slopes and ditches by erosion should seem adequate justification for wholehearted cooperation of all private and governmental agencies in meeting this phase of the problem. In addition the economic loss from silting, while generally less spectacular, in many instances justifies a large expenditure of effort and funds by all agencies affected or involved in erosion control.

The eminent Economist and Author Stuart Chase says, "The people of America have been sitting on their porches watching their continent go by. Three billion tons of solid continent are washed into the oceans every year by soil erosion, largely man-made. It would take a freight train 475,000 miles long to cart this continental slice away. Such a train would girdle the equator nineteen times".

The nation, including all public and private agencies, should be alarmed by the additional fact that only a small portion of the material removed by erosion reaches the oceans. Deposition of such materials begins as soon as wind or water velocities decrease, with only the lighter particles remaining in suspension until they reach the ocean. Boulders and stones, gravel and sand, silt and clay are strewn over fertile agricultural areas and choke our water courses.

In common with other private and governmental agencies, highway users, administrative officials, engineers, and all highway industries are vitally concerned in the adequate and early control of this dual menace.

Selfish interest alone demands not only that this Highway Research group promote and foster in every possible way such location, design, construction and maintenance of highways as will reduce to a minimum erosion and silting arising therefrom, but also that they join forces with other agencies in working beyond the highway right-of-way towards the early subjugation and continuous control of this national menace.

QUESTIONNAIRE AND REPLIES RECEIVED
AT THE
JOINT MEETING OF COMMITTEES
ON
DESIGN, MAINTENANCE AND ROADSIDE DEVELOPMENT
HIGHWAY RESEARCH BOARD

November 18, 1936.

PURPOSE: In order to promote more satisfactory drainage, more complete safety, and more pleasing roadside appearances, and to effect more economic maintenance operations, SHOULDERS, DITCHES AND BACK SLOPES are subjects of common interest to Engineers of Maintenance, Design, and Roadside Development. This questionnaire, or outline, is furnished in order to outline more clearly a program for discussion, and furnish an opportunity for each individual present to express his own ideas pertaining to the various factors.

DEFINITION OF TERMS:

Highway - The entire area between the right of way lines
Roadway - The traveled surface
Roadside - The area between the traveled surface and the right of way line.

SHOULDERS - ZONE 2*

1. Are shoulders a part of the roadway or the roadside?

   A. Maintenance standpoint (Roadway)- Reason:
   B. Design (Safety) standpoint (Roadway) - Reason:
   C. Roadside Development standpoint (Roadway) - Reason:

The expression of opinion was practically unanimous in considering that shoulders are part of the roadway because the utility of the traveled way is largely dependent upon having satisfactory shoulders. A few exceptions were noted in considering the shoulders as a part of the roadside where there may be a lip curb at the edge of the pavement and where grass is grown and maintained on the less important roads, making shoulder maintenance generally a separate operation. In other words, as the importance of the trafficway increases due to increased traffic-volume, the importance of the shoulders as an integral part of the roadway also increases. As the traffic use of shoulders decreases, in favor of grassing or sodding, shoulders tend to be considered as roadside features because of the similarity of roadside operations in the maintenance program.

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*Zone 1, Traffic Zone; Zone 2, the transition or shoulder Zone; Zone 3, Drainage Zone; Zone 4, Roadside, involving sidewalks, pole lines, trees, parking area, etc. and Zone 5, area adjacent to the highway.

2. What shoulder widths are essential on an 18-ft. roadbed? 20-ft. 30-ft. 40-ft. 60-ft. What exceptions?

The essential widths of shoulders vary from 5 ft. to 12-ft. . The majority of replies, however, considered 10 to 12-ft. as necessary for the more important highways except in heavy graded sections. One or two replies considered 8-ft. in cuts and 10-ft. in fills as good practice, in order to effect economical construction through the cut sections. Several replies indicated 11-ft. as desirable. One suggests 7-ft. to 8-ft. of clean, stabilized all-weather surface as a minimum requirement.

The general indication was that as the roadbed widened, the shoulders also should be widened, but one reply favored the reverse process: 11-ft. for an 18-ft. roadbed, 10-ft. for a 20-ft., 8 ft. for a 30-ft. width, and 5-ft. shoulders on 40-ft. and 60-ft. roadbed graded sections.

3. What constitutes the best shoulder material? i.e., soil - soil surface treated - grass sod - gravel (clay or washed) - slag or stone screenings - rough surface macadam bonded - uniform width recommended 3-ft. - 4-ft. - 5-ft. - 6-ft. when bordered with grass sod.

There was considerable difference of opinion as to what constituted the best shoulder material. There was general agreement, however, that the selection was dependent upon the local materials available, and the best material would be that which would stabilize the shoulder at the lowest cost.

A shoulder of rough surface macadam bonded or of slag or stone screenings was generally favored, for a width of 5-ft. to 6-ft., with sod border for the remainder of the shoulder width. One reply suggested the soil be surface-treated for a width of 10-ft. Another indicated that grass sod is satisfactory for light traffic roads but that macadam should be used where traffic is heavy. Sod was favored in connection with lip-curb sections and secondary highways. One reply suggested 5-ft. to 6-ft. of grass or low cost bitumen as a minimum requirement. The conclusion may be briefly stated that shoulders on the more important roads at least should have the surface stabilized 6-ft. wide or one car width, with sod or grass beyond such a treated width, where conditions are favorable.

4. What rate of slope is necessary? Surface treated ---- Gravel ---- Sod.

The rate of slope for surface treated shoulders ranged from $\frac{1}{4}$ to $\frac{1}{2}$ inch per foot, with the latter more generally favored. For gravel, the rate of slope of $\frac{1}{2}$ inch per foot to $\frac{3}{4}$ inch per foot was indicated, with opinion about equally divided. On sodded or grassed shoulder slopes, $\frac{3}{4}$ inch, 1 inch, and $1\frac{1}{2}$ inch per foot were recorded, with the majority of opinion favorable to a rate of slope varying from $\frac{3}{4}$ to 1 inch per foot. The general conclusion of the various rates presented indicated that $\frac{1}{2}$ inch for surface treated slopes, $\frac{3}{4}$ inch for gravel, and 1 inch for sod represented the present trend in highway practice for average conditions.

5. Under what conditions is curb and gutter construction advisable to replace shoulders? Describe suggested types for varying conditions.

The following conditions were noted under which curb and gutter construction might be advisable to replace shoulders:

Mountain sections, hilly country, steep grades, cities and towns, lip-curb on grades to carry water and lip-curb in sandy soils. Also urban approaches, narrow rock cuts where right of way is restricted, and through cuts which wash badly.

DRAINAGE - ZONE 3

6. What constitutes (A) Ditch? ---- (B) Gutter?

Several factors were noted as to the distinguishing characteristics of ditches and gutters. Ditches are usually unpaved and placed outwardly at the bottom of a slope and separate from the pavement, while gutters may be paved or surfaced and placed next to the pavement (adjacent to it) or as a part of the pavement. A ditch was also described as a natural soil waterway and a gutter as a paved waterway. Another stated that a ditch - type of section was usually not passable by vehicles because of its steep banks while the sloping banks of gutters which may also be paved are negotiable by vehicles.

7. What is the minimum depth required for adequate drainage of roadbed?

Opinion as to the minimum depth of ditch or gutter required for adequate drainage of the roadbed varied between 12-in. and 24-in., depending upon soil characteristics and other local conditions, with the shallower depth of between 12-in and 18-in. being most favored.

One reply stated that the depth should be 3-in. below the bottom of the roadbed base. Deeper depths might be necessary and desirable under special conditions. The questionnaire was not clear whether the reference point for this depth should be the edge of shoulder, edge of surfacing, or center-line profile elevation.

8. What is the minimum distance from the edge of the ditch to the edge of the pavement? (See question on shoulder width).

The minimum distance from the edge of the ditch to the edge of the pavement depends on the depth of ditch, which must have a flat slope to the top of shoulder. This has a direct relation to the width of shoulder adopted for the cross-section. General opinion indicated that an 8-ft. to 10-ft. shoulder with a 4 to 1 or flatter slope to depth of a shallow type of gutter or ditch was favored as a minimum.

9. What is the best cross section of (A) Ditch? (B) Gutter? Show rate of front slope and rate of back slope desirable.

A wide shallow type of ditch or gutter with 4 to 1 or 5 to 1 front slopes and 3 to 1 back slopes well rounded appeared to be preferred. A few suggested 2 to 1 front slopes for ditches and 4 to 1 front slopes for gutters as suitable.

10. What is the most economical treatment to prevent erosion in drainage areas? Naturalistic: (A) Sod, (B) Local material (shale, gravel, stone, etc.), (C) Dry rubble, (D) Ditch checks or baffles, (E) Subsurface pipe. Artificial or Mechanical Construction: (A) Masonry --- concrete, (B) Brick, (C) Grouted stone, (D) Etc.

Sod and other local materials were suggested as economical treatment to prevent erosion for small amounts of water in gutters while dry rubble or grouted stone was indicated under more adverse conditions, where heavy grades or large amounts of water are involved. Also ditch checks or baffles were advised where much water on heavier gradients was a problem. Subsurface pipe might be used instead of deep ditches. The naturalistic treatments seemed to be favored over artificial or mechanical construction wherever possible according to local needs. The latter should only be used in extreme cases where the former would not be satisfactory to meet the particular conditions.

11. Is the naturalistic effect generally preferable to the artificial? Yes ______ No ______

Every reply except one preferred the naturalistic effect to the artificial.

12. In general, has sufficient consideration been given in design to provide for (A) Releasing water from the roadway drainage area to the natural drainage area?
Yes ________ No ________ (B) Water entering drainage area from Zone 5.

It was the unanimous opinion in all the replies that insufficient attention or consideration has been given in design to provide for releasing water from the roadway drainage area to the natural drainage are. Time apparently did not allow all to fill out the next part of this question, but of those who did submit opinions on this point, it was indicated that more attention should also be given to the problem of water entering the roadway area from Zone 5 or the adjacent land areas.

ROADSIDES - ZONE 4

From erosion standpoint only --- Factors involving maintenance:

(A) Silting, (B) Gullying, (C) Sloughing, (D) Slides, (E) Wind erosion. Factors involving safety: (A) Slides, (B) Wind erosion, (C) Falling stones, boulders, trees, etc.

Insufficient replies were made to this question for any worthwhile conclusions, but the few replies entered indicated all factors were involved.

ATTENDANCE

*Attended St. Louis Meeting
**Attended Washington, D. C. Meeting
***Attended both Meetings

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*Morey, A. P.,
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**Murphy, W. T.,
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***Neale, H. J.,
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**Nelson, C. M.,
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*Palmer, R. E.,
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***Pesman, Walter,
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** Ramser, C. E.,
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*Rose, F. T.,
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***Sayers, F. W.,
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** Schappler, R. C.
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***Simonson, Wilbur H.,
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**Torkelson, M. W.,
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**Troeger, Philip,
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**Walker, J. H.,
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**Whitton, Rex M.,
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**Wiles, E. G.,
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*Williams, R. L.,
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**Wooldridge, F. E.,
U. S. Forest Service,
Washington, D. C.

7

**Worsham, Walter B.,
Illinois Department of Highways,
Springfield, Illinois.

**Yeoman, R. C.,
American Concrete Expansion Joint Co.
Chicago, Illinois.

NOTE: It was not possible to obtain a complete list of those attending the Meetings.

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